Electronic Services - Hayward, Ca
M17271X

Brüel & Kjær

7003/4

Portable Tape Recorders

7003 valid from serial no 705341
7004 valid from serial no 705416

037 – 0159

Service

1-800-225-9210
RON COBLEY

7003/4

Portable Tape Recorders

7003 valid from serial no 705341
7004 valid from serial no 705416

037 – 0159

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Trouble Shooting

If any faults should occur please check the instrument according to the Adjustment Procedure.

When a fault has been traced and corrected, the voltages and adjustments influenced by the correction must be rechecked. The complete instrument should then be tested to make sure that all basic functions are operative.

The tolerances given in these notes are intended for use as guide for adjustments.

Before correcting any apparent deviation make sure that the measuring instrument has tolerances small enough not to affect the measurement.

Modifications

Due to the constant technical progress the instrument will be modified from time to time in order to provide continously improved performance.

For this reason there may be small differencies between the instrument and the Service Instruction.

However, the local Representative Service is in possession of all information regarding the modifications that have been made.

Spare Parts

Please state type and serial number of the instrument when ordering spare parts.

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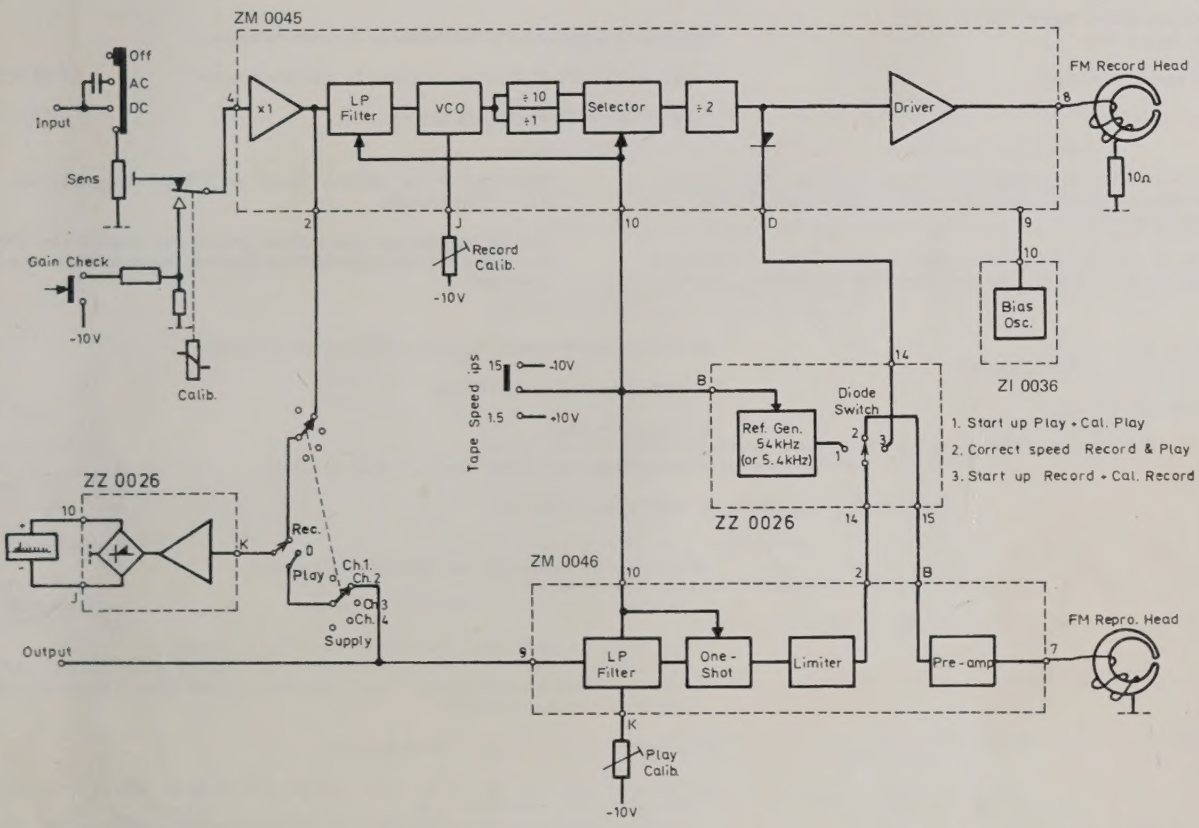
DESCRIPTION

The main advantages of the FM Recording Principle are that the frequency response is down to DC and the amplitude stability is absolutely excellent.

The FM Recording Technique utilizes a carrier signal the frequency of which deviates in proportion to the amplitude of the signal applied to the input of the recorder.

Since the information on the tape is consisting of frequency deviations of the carrier, the level at which the carrier is recorded or reproduced is relatively unimportant.

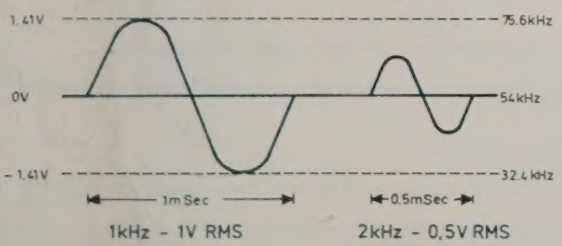
For Reproduction the amplitude of the previous recorded input signal is recovered by reproducing the carrier deviations and demodulating them.



7003 has two tape speeds and therefore also two carrier frequencies. On 15 i.p.s. 54 kHz is used as the carrier frequency and correspondingly 1.5 i.p.s. uses a carrier frequency of 5.4 kHz.

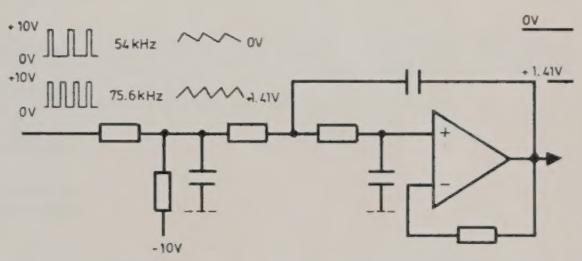
The maximum modulating frequency is approx. 1/5 of the carrier frequency which gives an upper limiting frequency of 10 kHz and 1 kHz on the two respective tape speeds.

The FM modulation takes place on ZM 0045 by means of a voltage controlled sawtooth generator which provides an impulse output of 108 kHz ±40%. This output is divided by 2 on 15 i.p.s. and by 10 and 2 on 1.5 i.p.s.



As the maximum input/output level is 1 V RMS, it actually means that an input voltage of +1,41 V produces a frequency of 75.6 kHz and −1,41 V produces 32,4 kHz on the tape at 15 i.p.s.

The reproduce signal from the tape is amplified and shaped to impulses of equal height and width by means of a one-shot multivibrator on ZM 0046. On 1.5 i.p.s. the impulses are 10 times wider than on 15 i.p.s. because the repetition frequency is 10 times lower.



An integrator converts the impulses to a voltage the amplitude of which is proportional to the number of impulses applied. Finally a succeeding low pass filter removes the remaining carrier frequency.

As can be seen on the Block Diagram above the Demodulation is controlled from three different sources selected by diode switches. The reason for this is to prevent that the Demodulator will ever be without input signal as this would cause noise on the output. The Demodulator is connected to the Reproduce Head and Preamplifier only when correct tape speed has been reached and this action is controlled by a signal from the Motor Servo Amplifier on ZZ 0026.

In "Calib. Play" mode 54 kHz is applied to the Demodulator and the respective potentiometer is adjusted for 0 V on the output. In "Calib. Record" mode the Modulator has 0 V on the input and the potentiometer connected to the VCO is adjusted for 0 V on the output which corresponds to 54 kHz VCO output.

CHECKING PROCEDURE

The following procedure is intended as a quick guide to tell if the Tape Recorder complies with the specifications.

As the four Channels are identical with the exception that the Microphone Input can be recorded on channel 1 only, the Procedure can be used for all the channels, while only Channel 1 is refered to.

In case of large deviations from the specifications it is likely to suspect a defective component which should be found and corrected by means of the oscillograms on the diagrams.

Smaller deviations, however, might be corrected by adjustments according to the Adjustment Procedure which is described later.

Meter and Monitor Switch: "Ch.–1"
Cal. Switch: "Play"

Adjust the "Play Calibration" potentiometer for minimum deflection.

Cal. Switch to "Record"

Adjust the "Record Calibration" potentiometer for minimum deflection.

Push "Gain Check"

The deflection should now be 0 dB ± 0,2 dB.

Connect a LF-Oscillator directly to a Frequency Analyzer or a Spectrometer and adjust the Output Level of the Oscillator to reach exactly 1 V RMS on the Analyzer at 1000 Hz.

Then check the frequency response of the two instruments and note possible deviations in order to exclude inaccuracies caused by Oscillator or Analyzer.

Finally connect the Oscillator Output to 7003 Ch.–1 Input and Ch.–1 Output to the Analyzer.

Load the Tape Recorder with a relative new and clean Magnetic Tape of the same type as the tape supplied with the Recorder. Depress the Meter Counter to read 000.

Ch.–1: "DC"
Input Sensitivity: "Fully clockwise"
Cal. Switch: "Off"
Tape Speed: "15 i.p.s."

Set 7003 to Recording mode and record 4 times 15 meters as follows:

1. Input signal: 1 V excatly, 1000 Hz.
2. Input disconnected.
3. Vary the frequency through the entire range up to 10 kHz.
4. Input Frequency 5000 Hz.

Rewind to 000, set 7003 to Play Back mode and check as follows:

1. Deflection 1 V RMS ± 0,2 dB (Sensitivity adjustment)
2. Max. 5,5 mV Average corresponding to a signal to noise ratio of 44 dB.
   (The frequency range of the Analyzer should be 20 Hz to 40 kHz and if the noise is too high, check Tape, Reels and Tape Tension. Clean Tape Heads and Pinch Rollers. Demagnetize the Tape Heads. LP Filter Adjustment.)
3. Deflection 1 V RMS ± 1 dB (LP Filter Adjustment).
4. Measure selectively at 10 kHz and check that the 2nd harmonic remains below 1,5% corresponding to a deflection of 15 mV.
   (Use Max. Octave Selectivity on the Analyzer. Too much distortion can normally be reduced by small adjustments of carrier current).

Ch.–4: "DC"
Input Sensitivity: "Fully clockwise"

Apply the same 10 kHz, 1 V RMS signal to the inputs of Ch.–1 and Ch.–4 simultaneously.

Connect a 2-Channel Oscilloscope to the outputs of Ch.–1 and Ch.–4. (Use Ext. Trig.).

Set 7003 to Recording mode and check that the average phase difference between the two channels is $0^{o} \pm 5^{o}$ and that the maximum deviations does not exceed 30^{o}.

If these requirements are not fulfilled the Mechanical Section should be consulted since adjustment of the Damping Roller between the heads or the Pinch Rollers might be necessary.

Meter and Monitor Switch: "Ch.–1"
Monitor: "On"

Connect the Microphone, depress the Meter Counter and set 7003 to Recording mode.

Now speak a few words into the Microphone while watching that the deflection on the meter does not exceed full scale.

Rewind to 000 and set 7003 to Play Back.

When listening to the Microphone the recorded words should be clear and easy to understand.

The same Checking Procedure (except Calibration) should be carried out at a speed of 1,5 i.p.s. as well, using 10 times lower frequencies and tape lengths.

At 1,5 i.p.s. the noise is specified to be max. 10 mV Average corresponding to –39 dB.

ADJUSTMENT PROCEDURE

If any adjustment is found necessary the voltages from the different power supplies should be checked as these are a basis for correct adjustment.

However, it should be taken into consideration that many circuits are utilizing balanced amplifier stages, the balance of which will alter if the + or −10 V supply is adjusted.

Power Supply

Cal. Switch: "Play"

Check measuring point +10 on ZZ 0026 for +10 V ± 10 mV (Adjustment on P 603).

Check measuring point −10 on ZZ 0026 for −10 V ± 10 mV (Adjustment on P 602).

Check measuring point +5 on ZZ 0026 for +5 V ± 5 mV (Adjustment on P 604).

If any of these voltages have been adjusted, the rest of the adjustment procedure has to be carried out.

If none of the voltages have been adjusted it might not be necessary to carry out the adjustments described under LP Filters, Carrier or Sensitivity

LP Filters

Cal. Switch: "Off"
Ch. −1 to Ch. −4: "DC"
Tape Speed: "15 i.p.s."
Mode Lever: "Record, Stand-by"

Apply 1 kHz to the respective "Input" and adjust the level of the Oscillator to read 0,8 V on an Electronic Voltmeter connected to measuring point Y 1 on ZM 0045

Change frequency to 18 kHz and adjust P 2 to −3 dB ref. to 1 kHz .

Tape Speed to "1,5 i.p.s."

Check that the −3 dB limit is now at 1,8 kHz.

Depress "Release"
Tape Speed to "15 i.p.s."
Cal. Switch to "Play"

Remove the connection between Y 100 and 101 on ZM 0046 and apply 1 kHz to Y 101.

Connect an Electronic Voltmeter to the respective "Output" and set P 100 and 102 to mid position.

Adjust the output level of the Oscillator to a reference deflection on the Voltmeter of 0,8 V.

Increase the frequency of the Oscillator until max. deflection on the Voltmeter, and adjust P 100 for a deflection of 0,8 V (The maximum is at approx. 7 kHz).

Increase the frequency to exactly 10 kHz and adjust P 102 for 0,8 V deflection.

Go back to 1 kHz and adjust the level of the Oscillator to the 0,8 V reference and repeat the adjustments of P 100 and 102.

After 4 to 5 repeated adjustments it is possible to have an absolutely flat response to 10 kHz and if the filter is correctly adjusted, the −3 dB point should be at 14,6 kHz.

Tape Speed to "1,5 i.p.s."

The frequency response should be flat to 1 kHz and be −3 dB at approx. 1,46 kHz.

After adjustment of the filter on ZM 0045 and ZM 0046 check Sensitivity

Carrier

Ch. −1 to Ch. −4: "DC"
Mode Lever: "Record, Stand-by"

Connect the Oscilloscope to the upper two terminals on the Head Assy. Board (Ch. −1)

The voltage should be approx. 220 mV pp and can be adjusted by P 3 (ZM 0045 Ch. − 1).

Sensitivity

a. Mode Lever: "Off"
Cal. Switch: "Off"

Adjust the meter mechanical to read −∞.

b. Cal. Switch to "Play"

Connect K to 9 on the ZZ 0026 socket and adjust P 605 "Bal." to minimum deflection.

c. Cal. Switch to "Off"
Mode Lever: "Record, Stand-by"
Tape Speed: "15 i. p. s."

Remove the connection between K and 9.

Check the frequency at testpoint Y 2 on ZM 0045 to be 54 kHz ± 50 Hz.
If necessary adjust "Record Calibration" potentiometer.

d. Ch.-1 to Ch.-4: "DC"
Input Sensitivity: "Fully clockwise"

Apply a voltage of excatly — 1,414 V to the "Input" in question and adjust P 1 on ZM 0045 to a frequency of 32,4 kHz ± 50 Hz on Y 2.
After adjustment remove counter and input voltage

e. Tape Speed: "1,5 i. p. s."
Meter and Monitor Switch to the respective channel.

Check the DC voltage on the respective "Output " to be OV.
If necessary adjust the "Play Calibration" potentiometers.

f. Tape Speed: "15 i. p. s"

Adjust C 114 on ZM 0046 to OV on the respective "Output ".
Repeat item e and f as the adjustments influence each others.

g. Tape Speed: "15 i. p. s."
Meter and Monitor Switch to the respective channel.

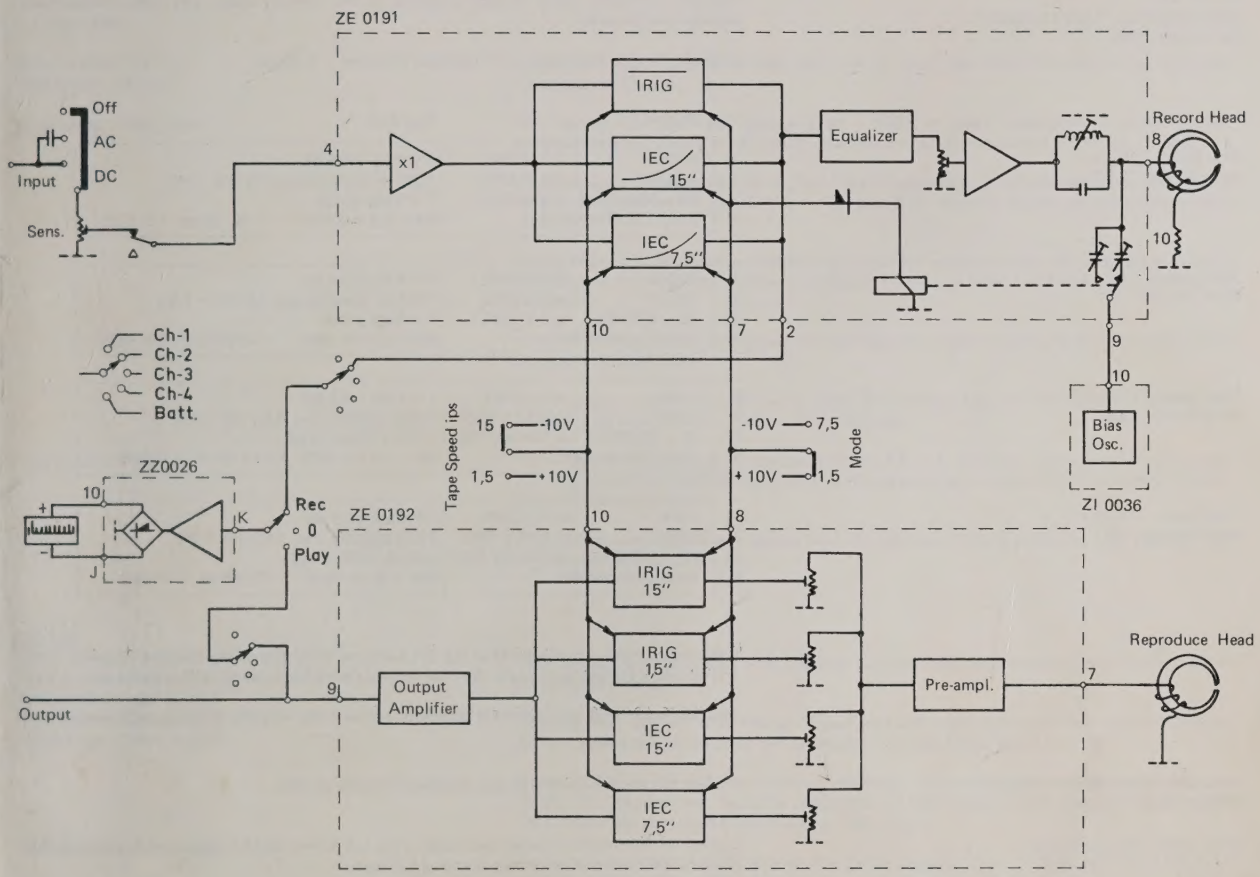
Input signal 1 kHz, 1 V RMS.

Adjust P 101 on ZM 0046 to, 1 V RMS on the "Output".
Adjust P 606 on ZZ 0026 for a deflection of 0 dB ± 0,2 dB on the built-in meter.

h. Depress "Release"
Cal. Switch to "Play"

Check the frequency at TP2 on ZZ 0026 to be 54 kHz ± 10 Hz.
If necessary adjust C 648.

DESCRIPTION



The Tape Recorder Type 7004 which utilizes the direct recording technique can be used in two modes each having two speeds.

When the "Mode Switch" is in position 1,5 the two speeds are 1,5 and 15 i.p.s. which allows frequency transformation of 1:10 and a frequency range to 50 kHz. This Mode is called the "Direct" Mode since recording takes place according to the IRIG Standard which demands linear recording.

With the "Mode Switch" in position 7,5 the speeds are 7,5 and 15 i.p.s. and the mode is called the "Audio" Mode . According to the IEC Standard the high frequencies are pre-emphasized when recording thus providing the best possible signal to noise ratio within the audible range.

When recording at 7,5 i.p.s. according to the IEC Standard the pre-emphasizing is 70 μsec. while 35 μsec. is used at 15 i.p.s.

As it can be seen from the Adjustment Procedure the two Modes request different bias adjustment which is the reason for the relay energized in the IRIG Mode.

When reproducing, the signal has to be equalized differently according to speed as well as mode since there is a loss in amplitude of both low and high frequencies. At the low frequency end this is due to the decreasing range of change of flux and at the high end due to the record wavelength becoming shorter compared to the width of the reproduce gap.

CHECKING PROCEDURE

ATT.: If a Standard Test Tape is used to check the Reproduction, it might happen that the output amplitude will decrease too much at the high frequency end. This is mainly due to the tolerances of the recording on the Standard Test Tape, which can easily be compensated by a small alingment of the Reproduce Head. However, if this alignment has been altered, the Reproduce Head should be adjusted back to its previous position.

The following Procedure is intended as a quick guide to tell if the Tape Recorder complies with the specifications.

As the two Channels are identical with the exception that the Microphone Input can be recorded on Channel 1 only, the Procedure can be used for both channels, while only Channel 1 is refered to.

In case of large deviations from the specifications it is likely to suspect a defective component which should be found and corrected by means of the oscillograms on the diagrams.

Smaller deviations, however, might be corrected by adjustments according to the Adjustment Procedure which is described later.

Before the Checking Procedure is started a LF-Oscillator should be connected directly to a Frequency Analyzer or a Spectrometer, while the Output Level of the Oscillator is adjusted to read exactly 1 V RMS on the Analyzer at 1000 Hz.

Then the frequency response of the two instruments should be checked in order to exclude possible inaccuracies caused by Oscillator or Analyzer.

Finally connect the Oscillator Output to Ch.–1 Input and Ch.–1 Output to the Analyzer.

Load the Recorder with a relative new and clean Tape and depress the Meter Counter to read 000.

Ch.–1: "DC"
Input Sensitivity: "Fully Clockwise"
Cal. Switch: "Off"

Record a sufficient length of tape according to the schemes below, and when Playing Back examine the following

1. Sensitivity – 2. Distortion – 3. Frequency Response – 4. Noise

Tape Speed: "15 i.p.s."
Mode Switch: "1,5"

	Record		Play Back
1	500 Hz	at 1 V RMS	1 V RMS ±0,5 dB
2	500 Hz	at 1 V RMS	1500 Hz selective max. 10 mV ~1%
3	25 – 50000 Hz	at 1 V RMS	1 V RMS ±3 dB
4	Input Disconnected		Max. 3,2 mV RMS ~–50 dB ref. 1 V RMS

Tape Speed: "1,5 i.p.s."
Mode Switch: "1,5"

1	500 Hz	at 1 V RMS	1 V RMS ±0,5 dB
2	500 Hz	at 1 V RMS	1500 Hz selective max. 15 mV ~1,5%
3	25 – 5000 Hz	at 1 V RMS	1 V RMS ±3 dB
4	Input Disconnected		Max. 3,2 mV RMS ~–50dB ref. 1 V RMS

Tape Speed: "15 i.p.s."
Mode Switch: "7,5"

1	1 kHz	at 1 V RMS	1 V RMS ±0,5 dB
2	1 kHz	at 1,41 V RMS	3 kHz selective max. 14,1 mV ~1%
3	25 – 20000 Hz	at 100 mV RMS	100 mV RMS ±2 dB
4	Input Disconnected		Max. 1,8 mV RMS ~–55 dB ref. 1 V RMS

Tape Speed: "7,5 i.p.s."
Mode Switch: "7,5"

1	1 kHz	at 1 V RMS	1 V RMS ±0,5 dB
2	1 kHz	at 1,41 V RMS	3 kHz selective max. 14,1 mV ~1%
3	25 – 18000 Hz	at 100 mV RMS	100 mV RMS ±2 dB
4	Input Disconnected		Max 1,8 mV RMS ~–55 dB ref. 1 V RMS

Distortion is measured selectively at the 3rd harmonic according to the standard. However, if the 2nd harmonic appears to be higher than the 3rd the record head should be demagnetized.

Also too much noise and decreased sensitivity indicates the necessity of demagnetizing the heads.

Meter and Monitor Switch:: "Ch.–1"
Monitor: "On"

Connect the Microphone and depress the Meter Counter to 000.

Mode Lever: "Record, Drive"

Depress the Microphone Contact and speak a few words into the Microphone while watching that the deflection on the meter does not exceed full scale.

Rewind to 000 and go to "Play-Drive".

When listening to the Microphone the recorded words should be clear and easy to understand.

Ch.–1 and Ch.–2: "DC"
Input Sensitivities: "Fully Clockwise"
Tape Speed: "15 i.p.s."
Mode Switch: "1,5"

Apply the same 20 kHz, 1 V RMS signal to the inputs of Ch.–1 and Ch.–2 simultaneously.

Connect a 2-Channel Oscilloscope to the outputs of Ch.–1 and Ch.–2 (Use Ext. Trig.).

Mode Lever: "Record, Drive"

The average phase difference between the two channels should be 0^{o} $\pm 5^{o}$ and the maximum deviations should not exceed 30^{o}.

If these requirements are not fulfilled the Mechanical Section should be consulted since adjustment of the Damping Roller between the heads or the Pinch Rollers might be necessary.

ADJUSTMENT PROCEDURE

As the IEC Standard demands a certain magnetic flux on the tape at the 0 dB Level, the correct adjustment of 7004 should be carried out by means of Standard Test Tapes. These tapes are BASF Bezugsband 38 for 15 i.p.s. IEC and BASF Bezugsband 19 s for 7,5 i.p.s. IEC.

ATT.
The Test Tapes must be handled with care and kept far away from magnetic fields, such as the surroundings of mains transformers, tape erasers etc.

ADJUSTMENT BY MEANS OF STANDARD TEST TAPES

IEC Reproduce

Mode Switch: "7,5"
Tape Speed: "15 i.p.s."

Demagnetize the Heads, load 7004 with the 15 i.p.s. Test Tape and connect an Electronic Voltmeter to "Output".

Mode Lever: "Play, Drive"

The first part of the Test Tape contains a 1000 Hz signal recorded at a Standard Level corresponding to 0 dB and P 402 should be adjusted to produce exactly 1 V RMS on "Output".

The Frequency Response part of the Test Tape is recorded at a −20 dB level and at 1000 Hz the output should be noted. At 18 kHz P 406 should be adjusted to give the same output as at 1000 Hz.

As the Standard Test Tape is recorded with a certain tolerance of the azimuth, the Reproduce Head should be tilted for maximum output at 18 Khz in order to obtain a correct electrical adjustment.

However, the Reproduce Head should be tilted back afterwards according to the Phase Adjustment procedure outlined below.

The frequency response should now be within ± 1 dB from 125 Hz to 18 kHz (ref. 1000 Hz) and within ± 2 dB from 31,5 Hz to 125 Hz (ref. 1000 Hz).

Tape Speed to "7,5 i.p.s."

The same procedure should be repeated with the 7,5 i.p.s. Test Tape where P 403 is adjusted for 1 V RMS at the first 1000 Hz signal and P 407 is adjusted for −1 dB at 18 kHz refered to 1000 Hz at the 20 dB reduced level.

After adjustment the response should be ± 1,5 dB from 125 Hz to 18 kHz (ref. 1000 Hz) and $^{+2}_{-1}$ dB from 31,5 Hz to 125 Hz.

IEC Bias

Mode Switch: "7,5"
Ch.−1 and Ch.−2: "AC"
Tape Speed: "7,5 i.p.s."
Mode Lever: "Record, Drive"

7004 should now be loaded with the tape supplied with the instrument or a similar type of recommended tape.

Apply approx. 300 mV at 10 kHz to "Input" and connect an Electronic Voltmeter to "Output" and an Oscilloscope to the upper two terminals on the Head Assy Board (Ch.−1).

Adjust C 518 on ZE 0191 to minimum deflection on the Oscilloscope. Then adjust until the 10 kHz on "Output" has passed a maximum and has dropped 3 dB compared to max. The Oscilloscope will now show a bias of approx. 600 mV_{p-p}.

Disconnect the "Input" signal, connect the Oscilloscope to TP on ZE 0191 and adjust L 502 for minimum 252 kHz bias $<$ 950 mV_{p-p}.

Connect the Oscilloscope to TP on ZE 0192 and tune L 401 to minimum 152 kHz erase voltage $<$ 300 mVp-p. The frequency can be adjusted by means of L 700 on ZI 0021
Tolerance: ± 0,5 kHz

Phase Adjustment

Mode Switch: "7,5"
Ch.−1 and Ch.−2: "AC"
Tape Speed: "15 i.p.s."
Mode Lever: "Record, Drive"

Connect a Double-Beam Oscilloscope to the Ch.−1 and 2 "Outputs" and record an 18 kHz sine wave signal to both tracks simultaneously.

Now adjust the Reproduce Head for a minimum phase difference between the two "Outputs".

A phase difference of 360° can be avoided by tuning down to a lower frequency for control.

IEC Record

Mode Switch: "7,5"
Ch.−1 and Ch.−2: "AC"
Tape Speed: "15 i.p.s."
Mode Lever: "Record, Stand-by"
Input Sensitivities: "Fully Clockwise"

Apply 1000 Hz exactly 1 V RMS to "Input" and adjust P 504 on ZE 0191 for 0 dB deflection on the 7004 meter. ("Meter and Monitor Switch" to the respective channel).

Depress "Drive" and adjust P 503 on ZE 0191 for an "Output" voltage equal to "Input" voltage ~1 V RMS.

Tape Speed to "7,5 i.p.s."
Mode Lever: "Record, Drive"

With the "Input" signal unchanged at 1 V RMS, 1000 Hz the "Output" voltage should be 1 V RMS ± 0,5 dB. (Possible readjustment of P 403).

Decrease the "Input" signal approx. 20 dB and note the "Output" level as a reference.

Adjust P 502 on ZE 0191 for a frequency response of 20 Hz to 18 kHz ± 2 dB.

Tape Speed to "15 i.p.s."
Mode Lever "Record, Drive"

Correspondingly P 501 should be adjusted for a flat response to 20 kHz ± 2 dB. However, at 25 Hz the tolerance is −3 dB.

IRIG Adjustment

Apply approx. 300 mV at 50 kHz to "Input", leave the Electronic Voltmeter connected to "Output" and connect the Oscilloscope to the upper two terminals on the Head Assy Board (Ch. — 1).

Mode Switch to "1,5"
Tape Speed to "15 i.p.s."
Mode Lever: "Record, Drive"

Adjust C 519 on ZE 0191 to minimum deflection on the Oscilloscope. Then adjust until the 50 kHz on "Output" has passed a maximum and has dropped 3 dB refered to max. The Oscilloscope will now show a bias of approx. 500 mVp-p. Disconnect the Oscilloscope.

Change the "Input" signal to 500 Hz exactly 1 V RMS and adjust P 401 on ZE 0192 for an "Output" equal to "Input" signal.

P 405 should now be adjusted for a frequency response of 25 Hz — 50 kHz ± 3 dB.

Tape Speed to "1,5 i.p.s."
Mode Lever: "Record, Drive"

"Input" signal to 500 Hz exactly 1 V RMS. Adjust P 404 on ZE 0192 for an "Output" signal equal to "Input".

P 408 should be adjusted for a frequency response of 25 Hz — 5 kHz ± 3 dB.

ADJUSTEMENT WITHOUT STANDARD TEST TAPES

IRIG Bias

Input Sens.: "Fully Clockwise"
Mode Switch: "1,5"
Tape Speed: "15 i.p.s."

Demagnetize the Heads and load 7004 with the tape supplied with the instrument or a similar type of recommended tape.

Apply approx. 300 mV at 50 kHz to "Input", connect an Electronic Voltmeter to "Output" and connect an Oscilloscope to the upper two terminals on the Head Assy Board (Ch. — 1).

Mode Lever: "Record, Drive"

Adjust C 519 on ZE 0191 to minimum deflection on the Oscilloscope. Then adjust until the 50 kHz on "Output" has passed a maximum and has dropped 3 dB refered to max. The Oscilloscope should now show a bias of approx. 500 mV p - p

Disconnect the "Input" signal, connect the Oscilloscope to TP on ZE 0191 and adjust L 502 for minimum 252 kHz bias < 950 mVp-p.

Ch. — 1 and Ch. — 2 to "AC"

Connect the Oscilloscope to TP on ZE 0192 and tune L 401 to minimum 152 kHz erase voltage < 300 mVp-p. The frequency can be adjusted by means of L 700 on ZI 0021. Tolerance: ± 0,5 kHz.

IRIG sensitivity

Input Sens. "Fully Clockwise"
Mode Switch: "1,5"
Tape Speed to "1,5 i.p.s."

Apply 500 Hz exactly 1 V RMS to "Input" and adjust P 504 on ZE 0091 for 0 dB deflection on the 7004 meter. ("Meter and Monitor Switch" to the respective channel).

Connect a Frequency Analyzer or a Spectrometer to "Output" in order to measure the third harmonic of 1500 Hz.

Mode Lever: "Record, Drive"

Adjust the recording current by means of P 503 on ZE 0191 until the third harmonic comes to 1%.

Now adjust P 404 on ZE 0192 for an "Output" signal equal to the 1 V RMS "Input" signal.

Adjust P 408 for a frequency response of 25 Hz — 5 kHz ± 3 dB.

Tape Speed to "15 i.p.s."

Adjust P 401 for an "Output" signal equal to "Input" signal at 500 Hz and P 405 for a frequency response of 25 Hz — 50 kHz ± 3 dB.

IEC Bias

Mode Switch: "7,5"
Tape Speed: "7,5 i.p.s."

Apply approx. 300 mV at 10000 Hz to "Input", connect an Electronic Voltmeter to "Output" and an Oscilloscope to the upper two terminals on the Head Assy Board (Ch. — 1).

Mode Lever: "Record, Drive"

Adjust C 518 on ZE 0191 to minimum deflection on the Oscilloscope. Then adjust until the 10000 Hz on "Output" has passed a maximum and has dropped 3 dB compared to max. The Oscilloscope should now show a bias off approx. 600 mVp-p.

IEC Record

Input Sens.: "Fully Clockwise"
Mode Switch: "7,5"
Tape Speed: "7,5 i.p.s."
Mode Lever: "Record, Stand-by"

As the 1 kHz recording level has been fixed by the IRIG Sens. adjustment a 1 V RMS signal at 1 kHz applied to "Input" should give 0 dB reading on the 7004 meter. ("Meter and Monitor Switch" to the respective channel)

Change the frequency to 11 kHz and adjust P 502 on ZE 0191 for + 3 dB on the 7004 meter.

Tape Speed to "15 i.p.s."

Change the frequency to 28 kHz and adjust P 501 for + 3 dB on the 7004 meter.

IEC Reproduce

Input Sens.: "Fully Clockwise"
Mode Switch: "7,5"
Tape Speed: "15 i.p.s."
Mode Lever: "Record, Drive"

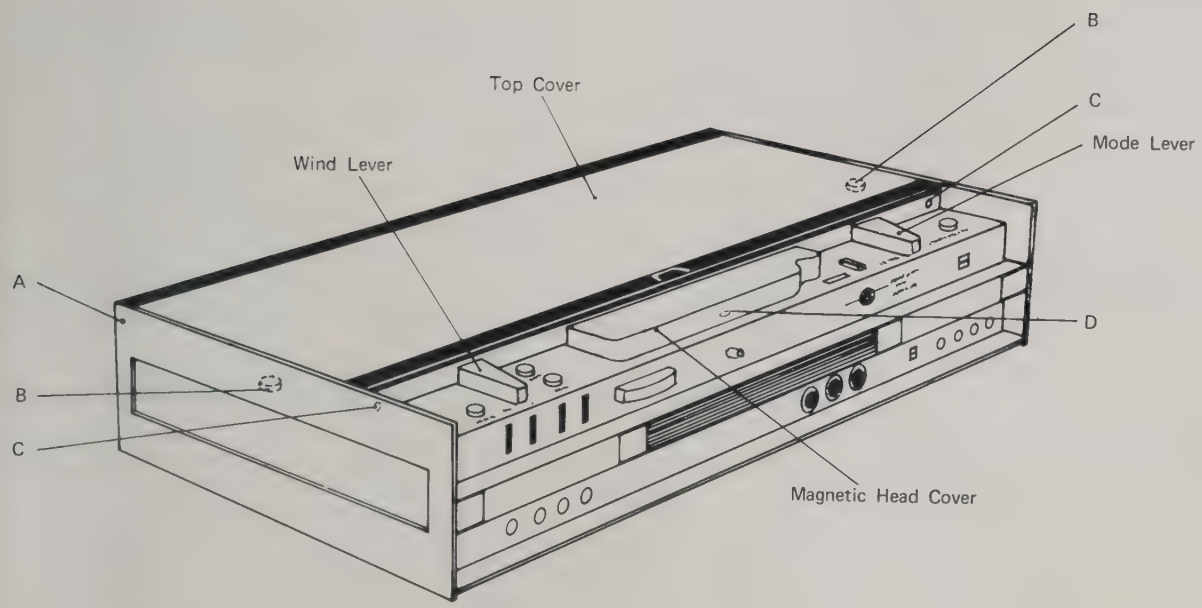
Apply 1000 Hz exactly 1 V RMS to "Input" and adjust P 402 on ZE 0192 for "Output" voltage equal to "Input" voltage.

At a 20 dB reduced "Input" voltage P 406 should be adjusted for 0 dB at 18 kHz ref. 1000 Hz.

Tape Speed to "7,5 i.p.s."

At an "Input" voltage of 1000 Hz, 1 V RMS P 404 should be adjusted for "Output" equal to "Input" voltage.

At a 20 dB reduced "Input" voltage P 407 is adjusted for —1 dB at 18 kHz ref. 1000 Hz.



MAINTENANCE, Routine

The ferrite heads should be kept strictly clean at all times. Remove loose dust and oxide particles from the head area with a soft brush. Clean the surfaces of the heads with a soft lint-free cloth dampened with head cleaner.

Caution: Do not use excessive amounts of solvent. Use only enough to dampen the cloth.

The capstans, pressure rollers and the guide rollers should be cleaned whenever there is any indication of dirt or oxide particles deposited on the surfaces. Use the same procedure as mentioned under the cleaning of the ferrite heads.

The entire tape deck compartment should be kept free from loose particles. The top hinged cover can be cleaned with a soft cloth dampened in water to which a small amount of mild soap is added. Finish with a clean soft cloth dampened in water.

MAINTENANCE, Every six months

Remove the rear cover and the battery pack. Unscrew bottom cover and remove the main printed circuit board by loosening the three retaining screws and withdrawing the board from its connector.

Remove all loose dust particles from the tape transport with a soft brush.

Clean both sides of the capstan drive belt with a soft cloth dampened with head cleaner solvent or Freon TF. Place the cloth on both sides of the belt and carefully pull the belt along its normal path until a complete passage has been made.

Care should be taken not to cause the belt to move excessive sideways as this will cause the sides of the belt to become damaged. The direction of pull should be such as to cause the center drive pulley to rotate counterclockwise seen from the bottom of the recorder.

Clean the peripheral surfaces of all belt pulleys with head cleaner or Freon TF.

DISASSEMBLY

The tape deck can be removed from the main frame as follows:

Remove the top cover by inserting a wire of max. 1 mm (0,040") diameter through the hole "A". Push in the spring loaded pin and lift the cover free. Disengage the pin at the opposite end.

Turn the Mode lever to either side in order to facilitate removal of the cover plate over the tape deck. Unscrew the two screws "B". Slide the cover plate forward and lift up at the rear edge. Take care not to damage the small rollers which protude through the cover.

Release the Mode lever and remove both levers by loosening their set screws one complete turn using a 2 mm (5/64") hexagon wrench.

Lift off the cover over the magnetic heads. Remove the two cable plugs at the magnetic heads. Also remove the cable plug at the right side of the tape deck and the cable plug on the drive motor printed circuit board at the rear.

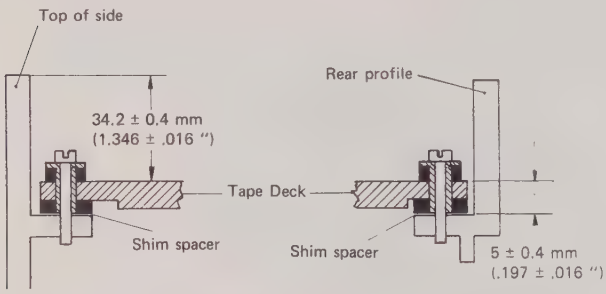
Remove the two screws "C" using a 2 mm (5/64") hexagon wrench. Also remove the screw "D" at the center of the top panel. Lift the top panel clear off the two lever shafts and tilt the entire assembly forward

Remove the four screws at the outer edges of the base plate using a 2,38 mm (3/32") hexagon wrench. Carefully lift out the entire tape deck by pushing it towards the rear and lifting up at the front until the capstan belt pulleys are clear of the front profile. Then slide the tape deck forward in order to clear the rear profile. Care should be taken not to damage the capstan belt.

ASSEMBLY

Bring the rear edge of the tape deck to rest upon the rear profile of the frame keeping the capstan pulleys clear of the front profile so as not to damage the capstan belt.

Slip the front edge of the tape deck down into the frame. Make certain that all cables and connectors are free.



Insert the rubber covered guide bushings into the holes in the tape deck (large diameter to either side, small diameter to the rear). The height of the tape deck should be checked at both sides and at the rear. If an adjustment is necessary remove or add a spacer.

Plug in the four connectors. The rotary switch will engage itself automatically

Tilt the front panel back over the two lever shafts and place the bottom edge into the slot of the front profile. Fasten the front panel with the two screws "C" and the centre screw "D".

Place the Mode and Wind lever on their shafts and tighten the screws with the levers placed 0,5 – 1 mm (0,020 – 0,040") above the top panel.

Turn the Mode lever to either side. Slide the top cover plate into position, coming from behind and moving the cover plate forward. Curve the cover slightly up in the middle to allow for two tension rollers to engage the holes in the cover. Then push the cover plate into the slot of the rear panel and fasten the cover with the two screws "B".

Place the fixed pin of the hinged top cover into the hole in the side of the frame. Depress the springloaded pin and slip the cover into position so the pin enganges the hole in the side of the frame.

Check that the cables are free of the capstan drive wheels.

ADJUSTMENTS

The adjustment procedure marked with

A: Indicates that the adjustments can be carried out after removing the cover plate over the tape deck and the bottom plate.

B: Indicates that adjustments require the tape deck to be removed from the main frame. Refer to "Disassembly" for this procedure.

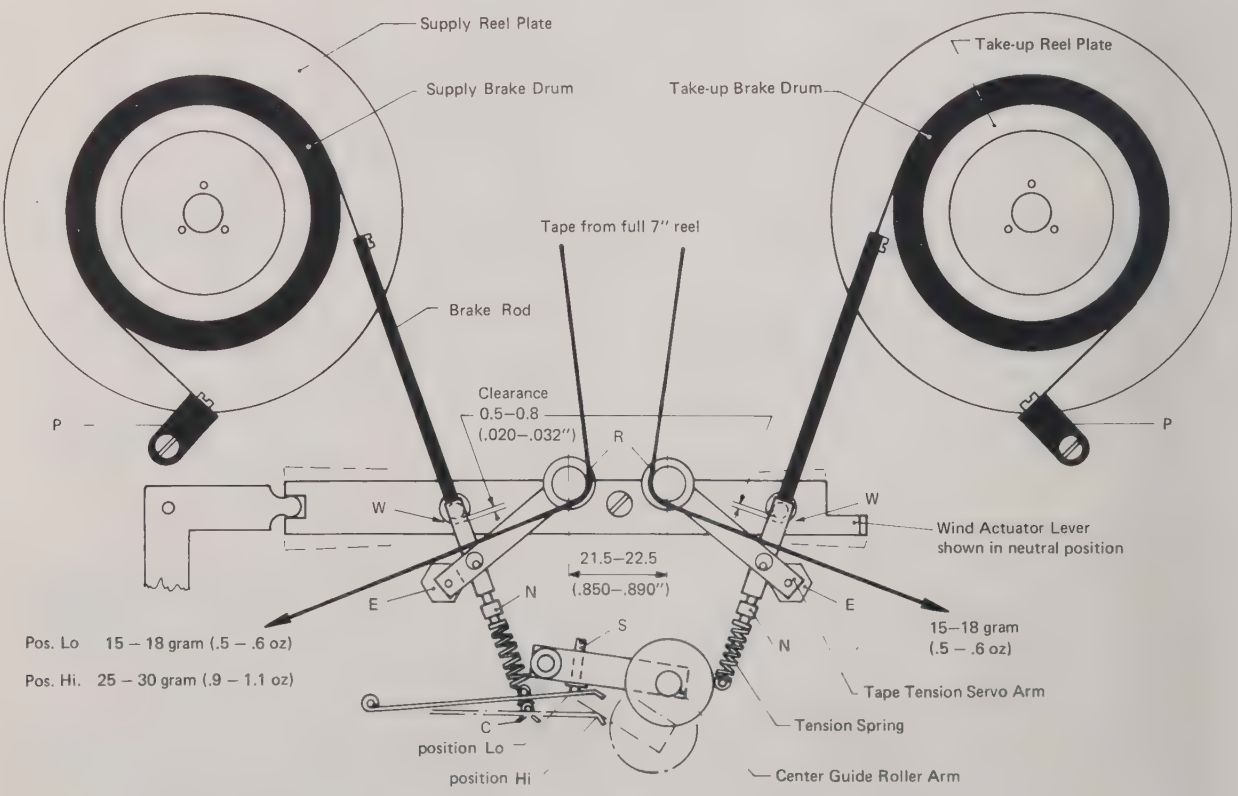


Fig 1

Top view

1.1. Tape Tension Rollers. "A"

On fig.1 the tape tension rollers are marked "R". With the Wind lever in neutral position and without tape on the recorder, the rollers should be straight across from each other with a distance between the centers of 21,5 – 22,5 mm (0,850 – 0,890").

If adjustment is necessary, first check that the clearance at point "W" (between the stud on the brake rod and the hole in the wind actuator lever) is 0,5 – 0,8 mm (0,020 – 0,032").

The clearance can be adjusted by the position of the brake band support "P".

If the brake band support "P" does not need an adjustment then the distance between the rollers can be adjusted at the excentric bearing "E".

The bearing is friction loaded and need not to be loosened. Turn the bearing to either side using an 8 mm =(5/16") flat wrench.

1.2. Supply Reel and Take-up Reel Brakes. "A"

Move Wind lever to either side and observe that the brake rod is moved 0,5 – 1 mm (0,02 – 0,040") by the wind actuator lever.

There are two holdback tensions for the supply reel. These are governed by the position of the center guide roller arm.

Position Lo gives the holdback tension for fast forward winding and position Hi gives the holdback tension for drive operation.

Turn Mode lever to position "Play" so center guide roller arm is in position Hi and place a full reel of tape on the supply reel spindle. Make a small loop on the end of the tape so a spring scale can be attached.

For a constant pull in the direction shown on fig.1 the scale should read 25 – 30 gr. (0,9 – 1,1 oz.).

If an adjustment is necessary turn nut "N" in for a higher tension and out for a lower tension. As the nut is placed under the pinch roller arm the adjustment should be carried out by turning the spring at point "C". The scale reading will vary a bit dependent on how steady the pull is. An average should be judged from the high and low readings.

Release the Mode lever so the center guide roller is position Lo and check the tension as for position Hi . The scale should read 15 – 18 gr. (0,5 – 0,6 oz.).

If an adjustment is necessary loosen nut on adjustment screw "S" and turn the screw in for a higher tension and out for a lower tension. Tighten the nut again.

There is only one holdback tension for the take-up reel. This holdback functions under rewind operation. Turn the nut "N" until correct tension 15 – 18 gr. (0,5 – 0,6 oz.) is obtained.

If the brake action is not sufficient clean brake drums and brake linings with freon

1.3. Take-up Tension. "A"

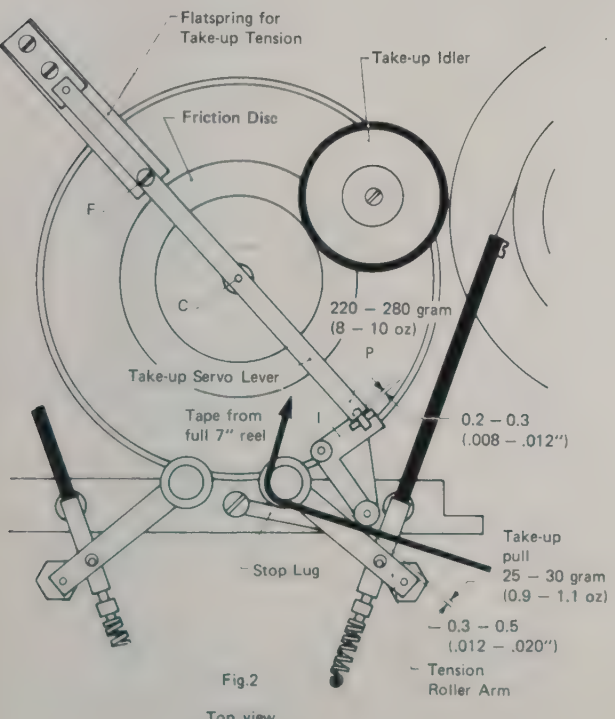


Fig.2

Top view

The take-up tension is servo controlled by the same tension roller which controls the holdback tension under rewind operation. The tension roller arm acts against an intermediate arm "I" which again acts against the take-up servo lever. The servo lever regulates the torque delivered by the center drive by varying the pressure exerted on the friction disc. The torque is transmitted to the take-up spindle by the take-up idler wheel.

Check the clearance between the small roller on the arm "I" and the side of the tension roller arm. It should be 0,3 – 0,5 mm (0,012 – 0,020"). If necessary move the stop lug to obtain correct clearance.

Then check the clearance between the other small roller on "I" and the bevelled surface of the take-up servo lever. Here the clearance should be 0,2 – 0,3 mm (0,008 – 0,012"). Adjustment is carried out by the screw "C". Us a 0,9 mm (0,035") hexagon wrench and lock the screw with lacquer or glue.

After the adjustment check the operation of the lever system by pushing the take-up tension roller towards the take-up reel. The take-up servo lever should be lifted high enough to relieve the pressure on the friction disc.

Check the tension on the take-up servo lever at the point marked "P": 220 – 280 gr. (8 – 10 oz.).

Place a full reel of tape on the take-up spindle. Thread the tape around the tension roller as shown on fig.2. Pull 0,5 m (1 1/2 ft) of tape from the reel. Attach the spring scale and start the recorder. Slowly allow the tape to be wound up on the reel.The scale should read 25-30 gr. (0,9-1,1 oz.) otherwise adjust the screw "F". Use a 4 mm (5/32") wrench for the adjustment nut and lock the screw and nut with lacquer or glue.

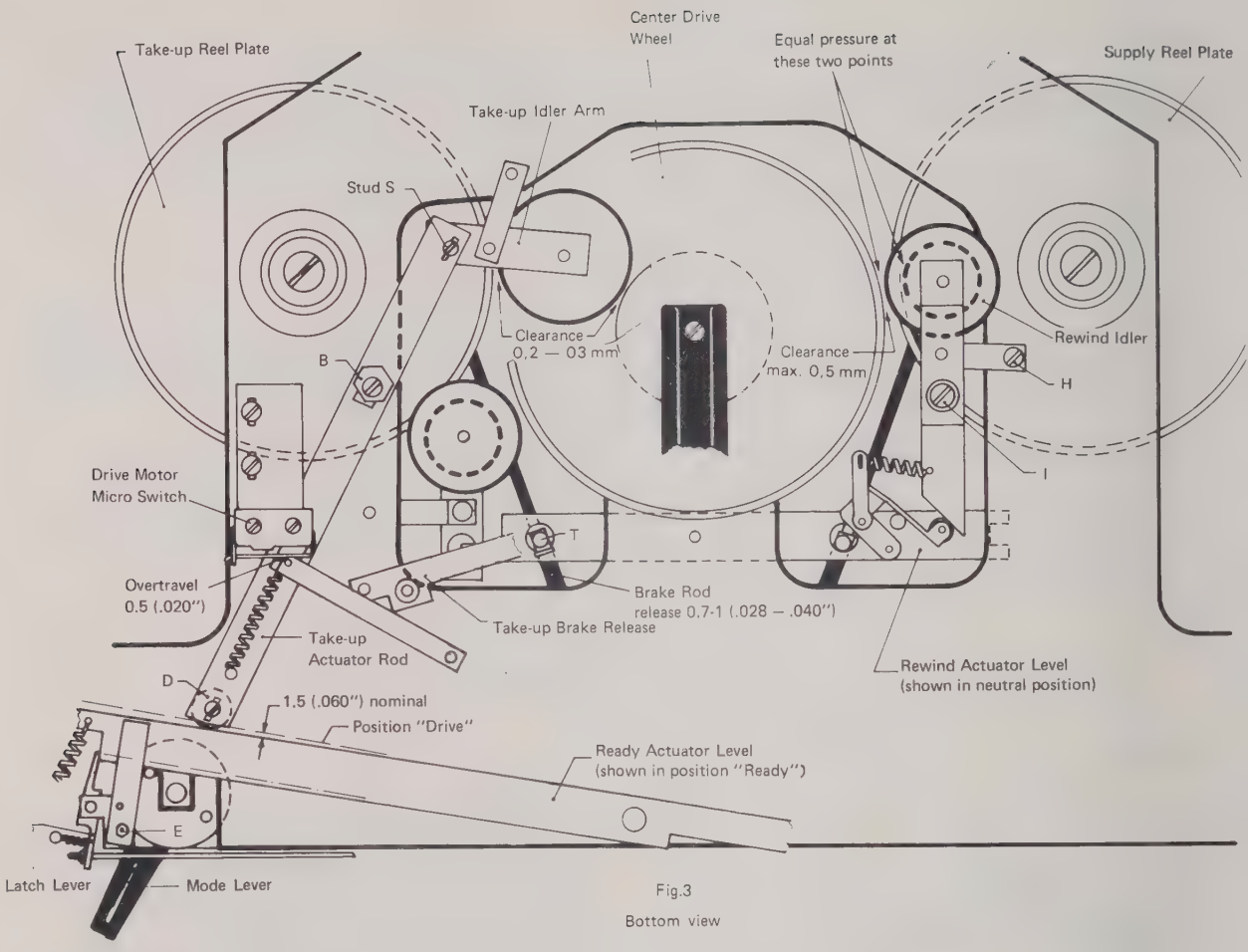


Fig.3

Bottom view

1.4. Drive Function (Take-up Actuator). "A"

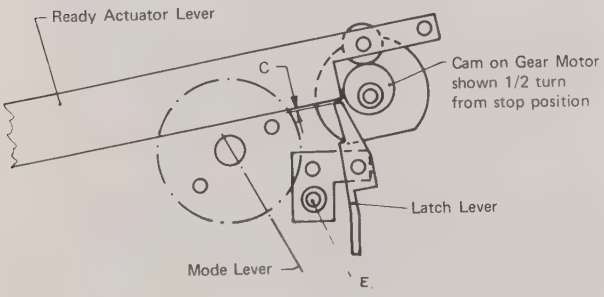


Fig.4

Top view

Upon initiation of DRIVE a small gearmotor will lift the ready actuator lever from position "Ready" to position "Drive". In this position it will be held by the latch lever. This movement can also during adjustments be done by hand by merely pushing the ready actuator lever until the latch lever locks it in position. The latch lever is released by the STOP button.

The movement of the ready actuator lever is transmitted to the take-up actuator rod which in turn releases the take-up brake, engages the take-up idler wheel and starts the drive motor.

The small disc "D" determines the travel of the take-up actuator rod. It is nominal 1,5 mm (0,060"). The correct amount of travel should move the take-up brake rod 0,7 — 1 mm (0,028 — 0,040").

The micro switch mounting plate should be adjusted for 0,5 mm (0,020") overtravel from the switch-on position of the two micro switches.

The cam on the gear motor will rotate one revolution whenever DRIVE is depressed. On fig.4 the cam is shown one half turn from its stop position to illustrate the clearance "C" which is necessary for proper action of the latch lever.

The clearance "C" should be 0,2 — 0,3 mm (0,008 — 0,012"). This clearance can be checked by observing the latch lever and the ready actuator lever through the large hole in the base plate next to the Mode lever.

Place the Mode lever in position "Play" and press DRIVE. An adjustment of the clearance can be made by loosening the nut at point "E" using a 5 mm (0,196") wrench and moving the latch lever holder to obtain the correct clearance.

1.5. Take-up and Rewind Idlers. "A"

The stud "S" (see fig.3) which controls the take-up idler arm should be adjusted to a position giving 0,3 – 0,5 mm (0,012 – 0,020") clearance between the stud and the edge of the hole in idler arm. During adjustment the ready actuator lever should be in position "Drive". Use a 3 mm (0,120") wrench for the stud.

In position "Ready" check that the idler wheel is free from touching the rim of the take-up reel plate and the core of the center drive wheel. To obtain the proper clearance adjust the excentric bushing at point "B". Use an 8 mm (5/16") wrench for the bushing.

For proper rewind function the rewind idler wheel should contact the inside of the supply reel plate and the rim of the center drive pulley with equal pressure.

Place the Wind lever in position "Rewind". Relieve the pressure on the idler wheel by pushing against the idler arm so the idler wheel just leaves the rim surfaces. Turn the center drive wheel slowly and allow the idler wheel to touch the rim. Observe that the idler wheel touches the two rim surfaces simultaneously. If an adjustment is necessary loosen the screw "H" and reposition the idler assembly.

With the Wind lever in neutral there should be 0,3 – 0,8 mm (0,012 – 0,032") clearance between the idler wheel and the rim of the center drive. If an adjustment is necessary loosen the screw "I" and reposition the extension of the idler arm.

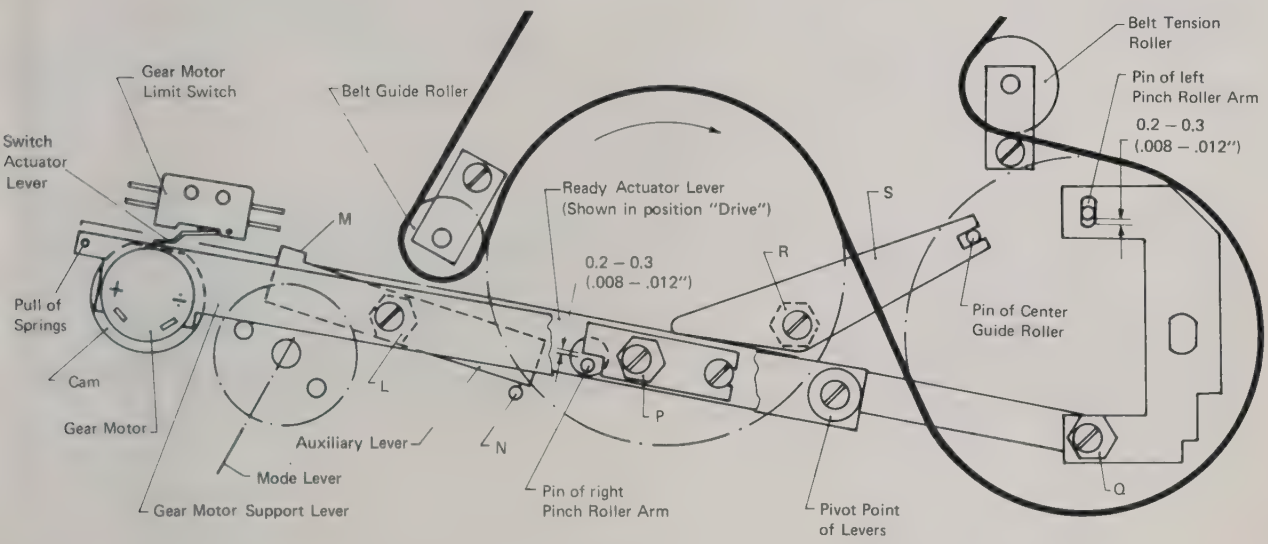


Fig.5
Bottom view

1.6. Gear Motor Limit Switch. "B"

On fig.5 the switch is shown with the flat on the cam of the gear motor facing towards the switch. This is the normal stop position. In this position and with the Mode lever in either position "Play" or "Record" the switch actuator lever should rest against the gear motor support lever.

Using a 1,5 mm (0,060") hexagon wrench as a gauge move the switch actuator lever 1,5 mm towards the switch. This should close the switch. An audiable click can be heard when the switch is closed. Now slowly allow the switch actuator lever to move outwards from the switch. Again a click should be heard at a point 0,2 – 0,3 mm (0,008 – 0,012") before the switch actuator lever rests against the gear motor support lever.

If an adjustment is necessary reposition the switch or carefully bend the switch actuator lever with a pair of flat nose pliers.

1.7. Pinch Roller Travel. "B"

The auxiliary lever located between the ready actuaor lever and the gear motor support lever must be so adjusted that it contacts the ready actuator lever at "M" and the pin "N" firmly when the Mode lever is in neutral position. An adjustment can be made at the excentric bushing "L".
Use an 8 mm (5/16") flat wrench for this adjustment.

With the auxiliary lever correctly adjusted both the ready actuator lever and the gear motor support lever will be held firmly against the two pins of the Mode lever shaft in neutral position by the two extension springs.

The ready actuator lever governs the travel of both the left and the right pinch roller. When moved to position "Ready" by the Mode lever there will be approx. 0,3 mm (0,012") clearance between the pinch rollers and their respective capstan. When moved to position "Drive" through the action of the gear motor the pinch rollers will contact the capstans.

The pins of the pinch roller arms which protrude through holes in the base plate should in position "Drive" have 0,2 – 0,3 mm (0,008 – 0,012") clearance to the levers acting against them. Adjustments can be carried out by the excentric bushings "P" and "Q". Use an 8 mm (5/16" flat wrench for this adjustment.

1.8. Center Guide Roller Travel. "B"

Movement of the center guide roller to a position between the two magnetic heads is accomplished by the lever marked "S" on fig.5. When the gear motor support lever is moved by the Mode lever it acts against lever "S", which in turn acts upon the pin from the center guide roller which protrudes through the base plate.

The guide roller should be held firmly in the advanced position. The pressure against the limit stop should be approx. 120 gr. (4 1/2 oz.). This can be measured using a spring scale with a string around the center guide roller.

If an adjustment is necessary turn the excentric bushing "R" using an 8 mm (5/16") flat wrench.

1.9. Stop Function. "A"

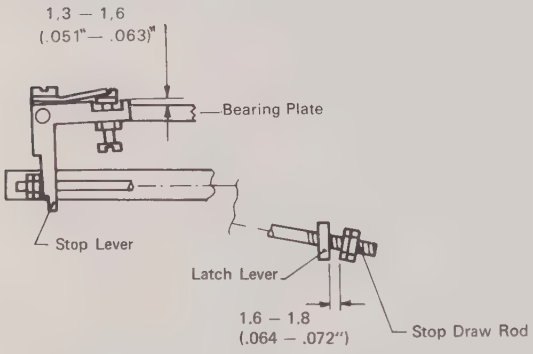


Fig.6

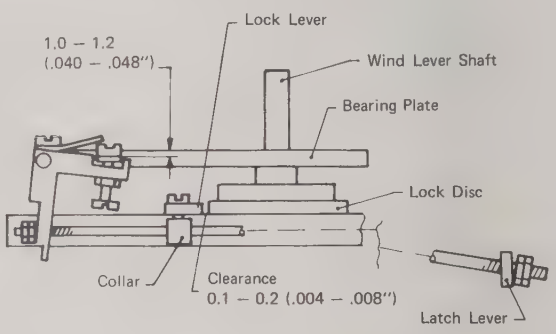


Fig.7

The stop lever which is activated by the STOP button is shown in its rest position. With the Mode lever in its neutral position there should be 1,6 – 1,8 mm (0,064 – 0,072") clearance between the latch lever and the two nuts on the stop draw rod. See Fig.6.

Fig.7 shows the stop lever in its activated position. This position corresponds to having the STOP button depressed or the solenoid activated. The top surface of the solenoid draw bar should be 1,0 – 1,2 mm (0,040 – 0,048") under the top surface of the bearing plate. Adjustments can be made by inserting or removing a washer at the solenoid plunger.

In the activated position check that the latch lever has moved 0,5 – 1,0 mm (0,020 – 0,040") away from the ready actuator lever.

Check also that the lock lever has 0,1 – 0,2 mm (0,004 – 0,008") clearance from the outside diameter of the wind shaft lock disc.

If an adjustment is necessary move the collar on the stop draw rod accordingly. Hold the stop draw rod positioned parallel to the edge of the base plate while tightening the screw of the collar.

1.10. Release Function. "A"

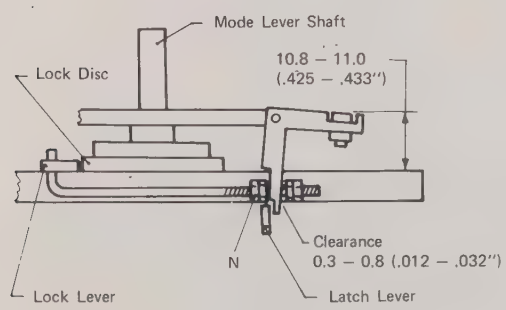


Fig.8

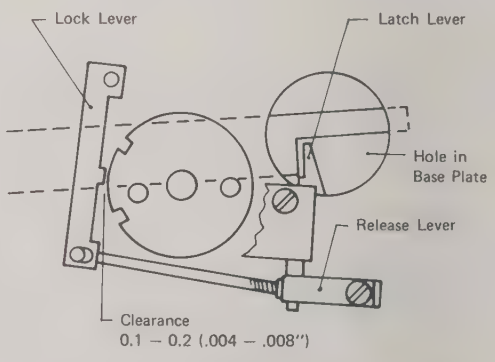


Fig.9

The release function is shown on Fig.8 and Fig.9. With the release lever depressed to a distance of 10,8 – 11,0 mm (0,425 – 0,433") from the base plate, there should be 0,1 – 0,2 mm (0,004 – 0,008") clearance between the lock lever and the outside diameter of the Mode shaft lock disc.

If an adjustment is necessary loosen the two M 2 nuts at "N" and adjust accordingly. Tighten the two nuts against each other. The two other nuts should have a clearance of 0,3 – 0,8 mm (0,012 – 0,032") to the release lever.

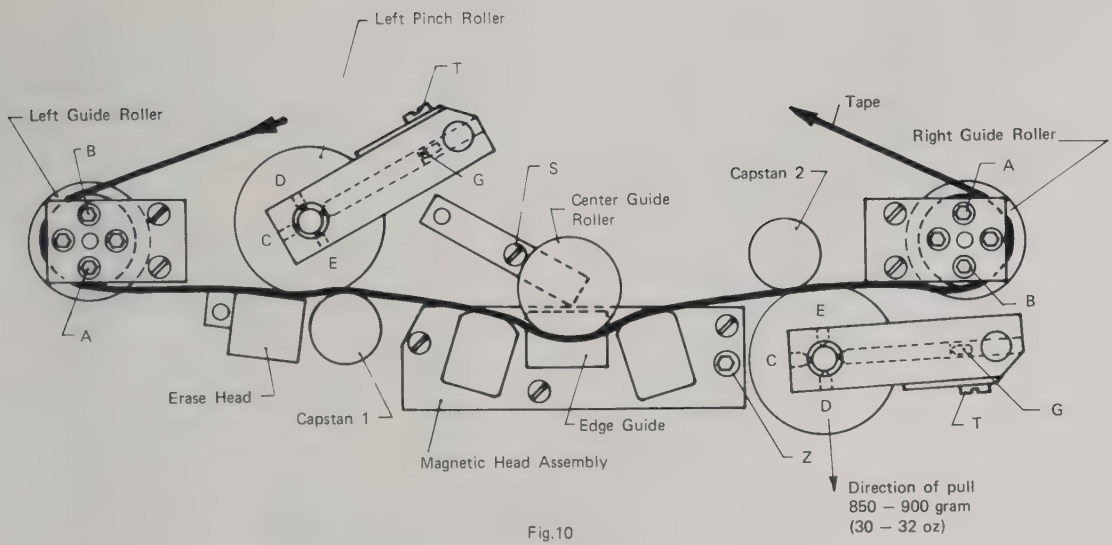


Fig.10

1.11. Magnetic Head Assembly. "A"

The head assembly may be removed from the tape deck without loss of track height adjustment or azimuth adjustment. Disconnect the two cable plugs and unscrew the three retaining screws.

When remounting the head assembly care should be taken that the mounting surfaces are strictly clean.

Adjustment of the reproduce head and check of the tape transport is carried out as follows:

Record a signal 10 kHz, 1 V on channel 1 and 4 simultaneously at a tape speed of 15 i.p.s.

Connect a dual beam oscilloscope to the outputs of channel 1 and 4 and check the phase difference between the two channels.

Average difference: 0 $\pm 5^{o}$.

Max. difference: 30^{o}.

Before any adjustment move the left or the right pinch roller away from the capstan. If this results in a better phase relationship check 1.13 Pinch Rollers.

In case that the phase difference is independent off the pinch rollers adjust screw "Z" slightly. The correct position of the screw should not depart more than $\pm 15^{o}$ turn off the position set at the factory. If the phase difference can not be obtained check 1.12 Guide Rollers.

1.12. Guide Rollers. "A"

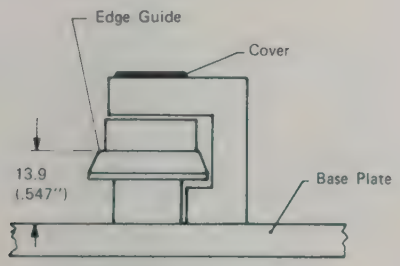


Fig.11

The left and right guide rollers are furnished with a single edge guide. For correct tracking the tape should always be in close contact with the edge guide of the two rollers.

The height of the edge guide above the base plate is carefully set at the factory and should not be disturbed.

Run some tape in FAST FORWARD position and observe how the tape is guided by the guide rollers. A slight bulge on the edge of the tape should be seen where the tape leaves the roller. If the tape does not contact the edge guide, check that the tape is threaded correctly at the tape tension rollers

If the tape is to be brought closer to the edge guide an adjustment of the tilt of the guide roller is necessary. Remove the plastic cover on top of the roller support. With a 2 mm (5/64") hexagon wrench loosen the socket screw "A" $5–10^{o}$ (see Fig.10). Tighten screw "B" the same amount. It should not be attempted to turn the screws more than 20^{o} from the original position. The two remaining screws should not be touched.

If the tape contacts the edge guide too heavily, which can be seen as a large bulge on the edge of the tape, the above adjustment procedure should be reversed

The center guide roller is tilted slightly in order to keep the tape edge in constant contact with the fixed edge guide located between the two magnetic heads.

The screw "S" on the arm supporting the roller sould be turned clockwise if the tape is to be brought in closer contact with the guide. This adjustment should only be made after having checked that the two pinch rollers are correctly adjusted, see 1.13 Pinch Rollers.

Whenever the guide rollers are adjusted check 1.11 Magnetic Head Assembly.

1.13. Pinch Rollers. "A"

The left and right pinch roller assemblies can readily be removed for inspection or replacement. With Mode lever in neutral position loosen the screw "T" (fig.10) and pull the entire assembly upwards. When replacing the assembly make sure to engage the release pin, which protrudes through the base plate, with the hole in the release lever.

Place Mode lever in position "Play" and measure the pull required to move the pinch roller slightly. Attach a spring scale in the socket screw "E" and tighten the screw "T" in a position giving a tension 850 – 900 gr. (30 – 32 oz.). Then move the pinch roller arm by hand to ascertain that they do not bind.

To align the pinch roller parallel to the capstan, loosen the erase head if the recorder is furnished with one and place a suitable light source at the capstan and observe the narrow beam of light. Press the roller towards the capstan to make the light beam more narrow. If there is an unequal amount of light along the line of contact, adjust either screw "D" or "E" using a 1,27 mm (0,050") hexagon wrench.

Run some tape on the recorder at a speed of 15 i.ps. Move the pinch roller momentarily away from the capstan by hand. Observe if the tape moves sideways where it leaves the capstan with the pinch roller engaged or disengaged. If the tape moves more than 0,2 mm. (0,008") upwards turn the screw "G" 20° out and turn the screw "C" an equal amount in. Repeat the adjustment if necessary. Do not, however, exceed more than 60° turn of the screws from their original position. If the tape still moves sideways it might be caused by a defective roller (curved surface) and a replacement of the roller is necessary.

After adjustment of the pinch roller fasten the erase head with a distance of 0,3 – 0,5 mm (0,012 – 0,020") from the left roller when the roller is held against the capstan.

Whenever adjustment of the pinch rollers are carried out check 1.11 Magnetic Head Assembly.

1.14. Capstan Belt Drive. "A"

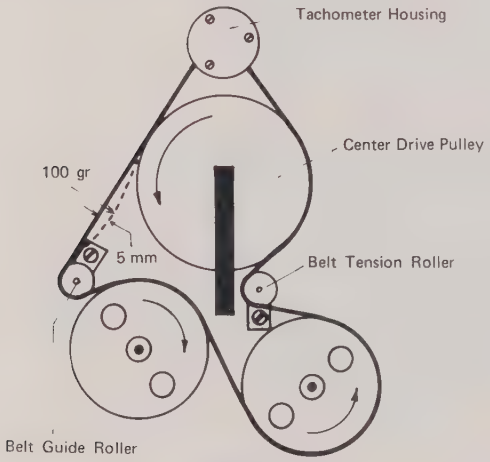


Fig.12

If it should become necessary to remove the capstan drive belt proceed in the following manner:

Loosen the belt tension roller to make the belt slack.

Remove the cover of the tachometer by unscrewing the three retaining screws. Note how the signal leads from the tachometer coil leaves the housing.

Remove the belt from the capstan pulleys and slide the belt carefully out of the tachometer housing along the inside edge while making a large loop in order to pass the toothed disc.

The belt tension can be adjusted at the belt tension roller. With 100 gr. (3 1/2 oz.) pressure against the belt applied midways betwwen the belt guide roller and the center pulley, the belt should deflect 5 mm (0,200").

The correct guiding of the belt upon the three large pulleys is mainly done by the small belt guide roller, which has a crowned surface. Tilting the arm away from the base plate will cause the belt to move closer to the base plate. It is important that the belt is rotated in the correct direction while making this adjustment. Do not attempt to tilt the arm holding the belt tension roller.

The correct belt position can be seen on the center pulley. The edge of the belt should be 0,3 – 0,8 mm (0,012 – 0,032") inside the edge of the pulley facing away from the base plate.

1.15. Motor Drive Belt. "A"

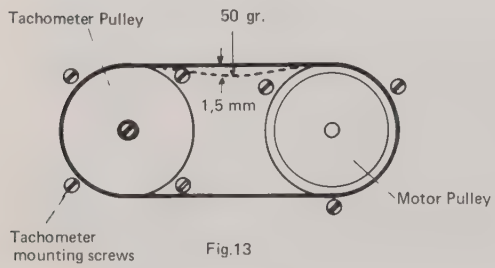


Fig.13

The belt can be removed by carefully guiding the belt off the edge of the pulleys while slowly rotating these. Note how the belt is orientated with respect to the base plate. Turning the belt upside down might cause the belt to travel incorrectly on the pulleys when it again is placed on the pulleys.

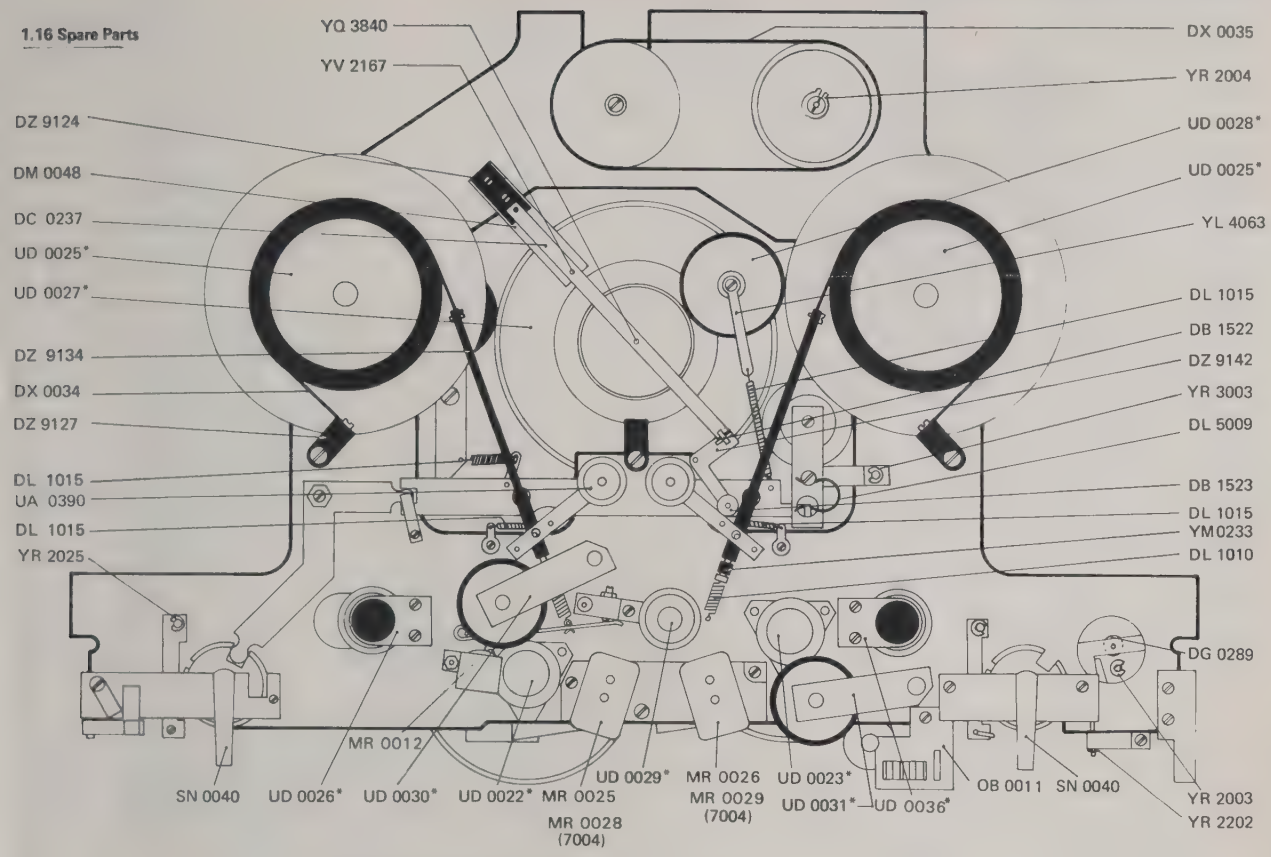
The correct belt tension can be measured as illustrated on fig.13. With 50 gr. (1 3/4 oz.) pressure against the belt applied midways between the two pulleys, the belt should deflect 1,5 mm (0,060"). The belt tension can be adjusted by loosening the four screws holding the tachometer housing and moving the housing to obtain correct tension.

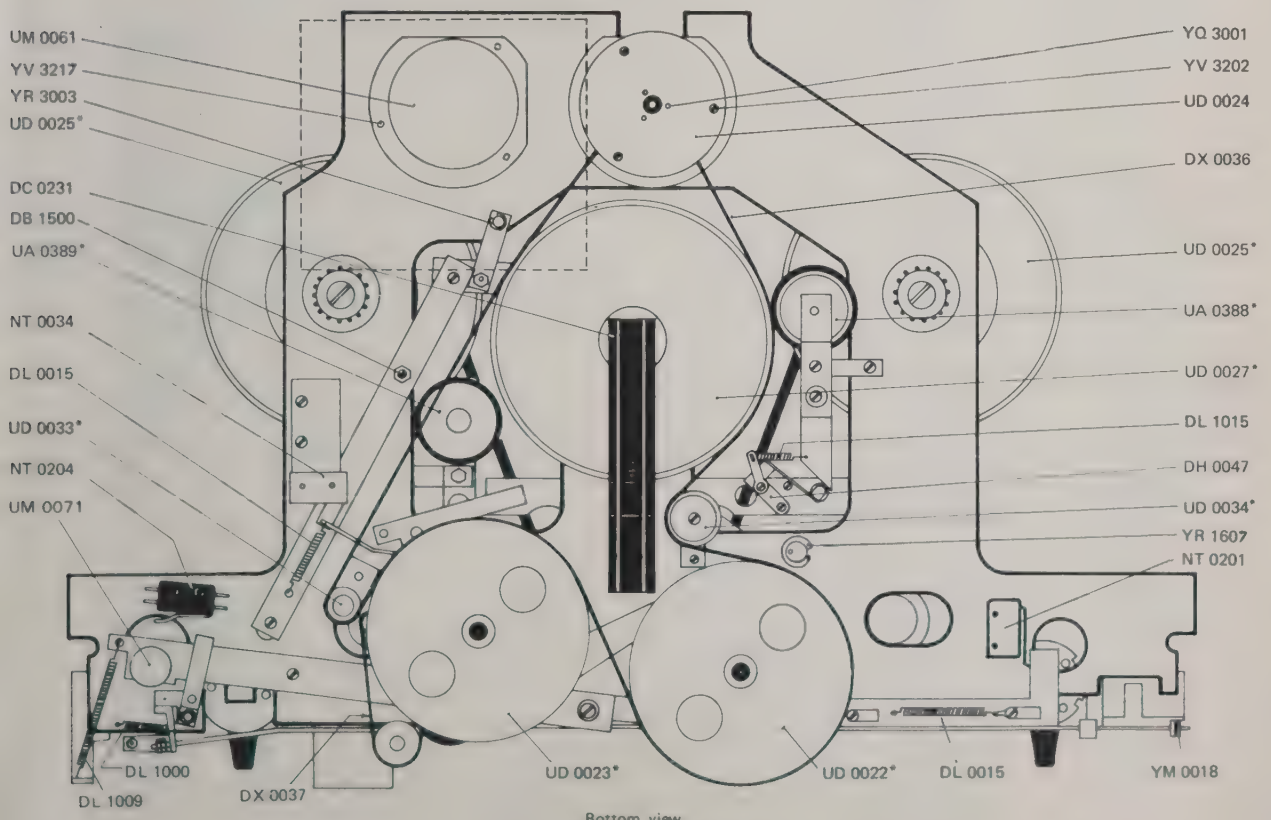
The guiding of the belt is accomplished by both pulleys as they both have a crowned surface.

If a new belt is to be installed it may be necessary to try turning the belt upside down in order to keep the belt running correctly on the pulleys.

1.16 Spare Parts

Top view



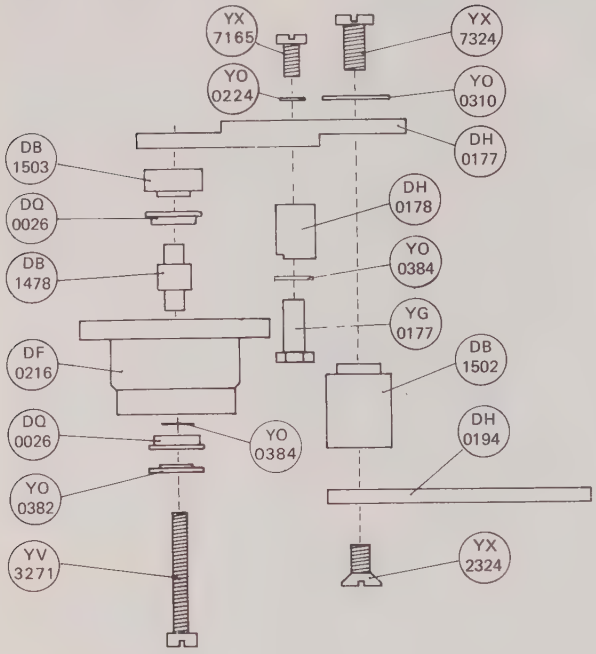


Bottom view

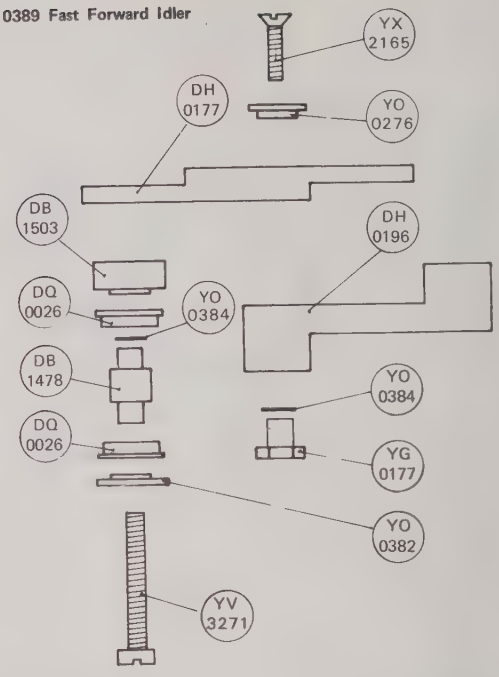
Parts marked * are complete units. Detailed drawings on the following pages.

7003 valid from serial no. 705341
7004 valid from serial no. 705416

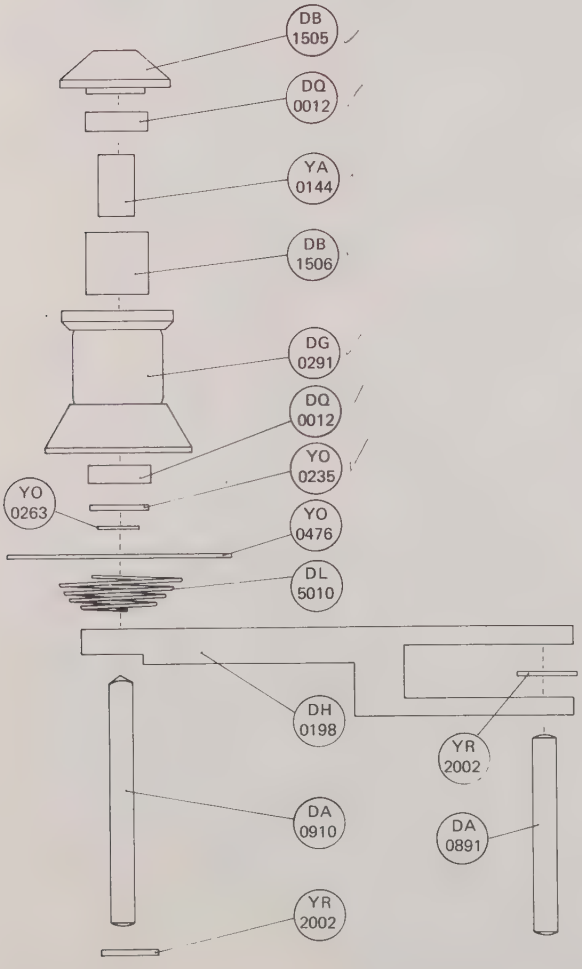
UA 0388 Rewind Idler



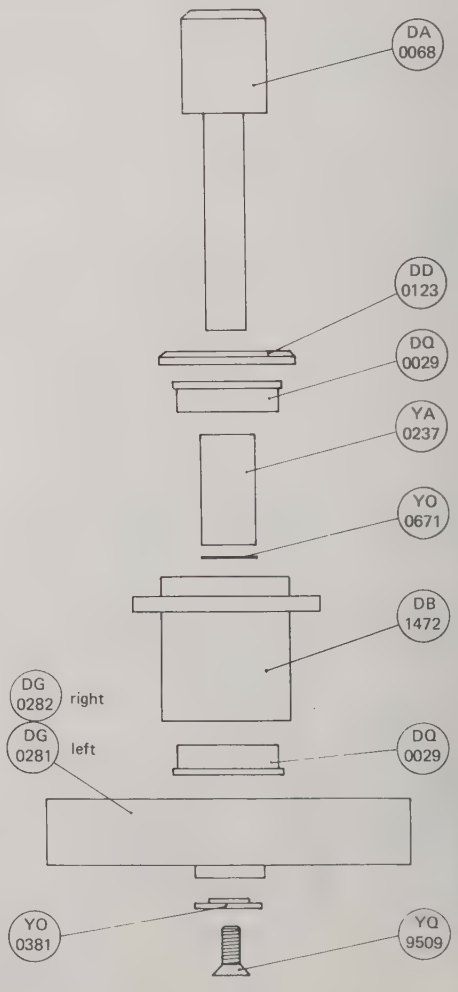
UA 0389 Fast Forward Idler



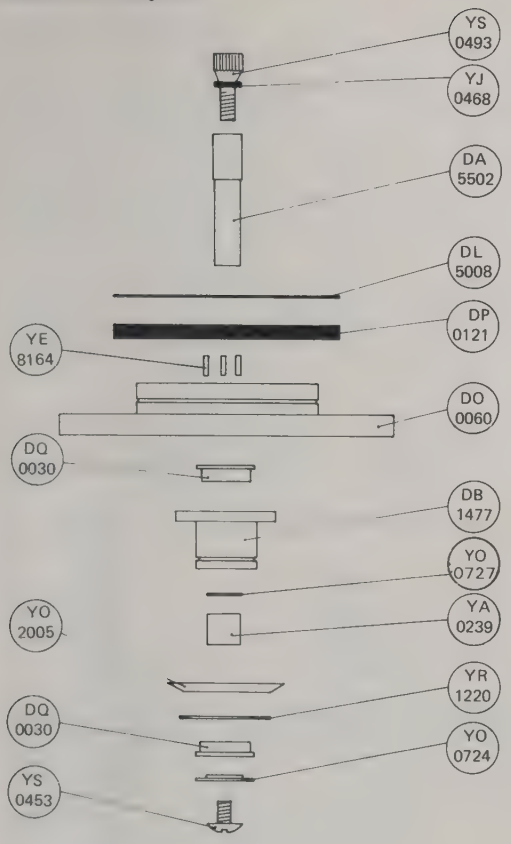
UA 0390 Tape Tension Roller



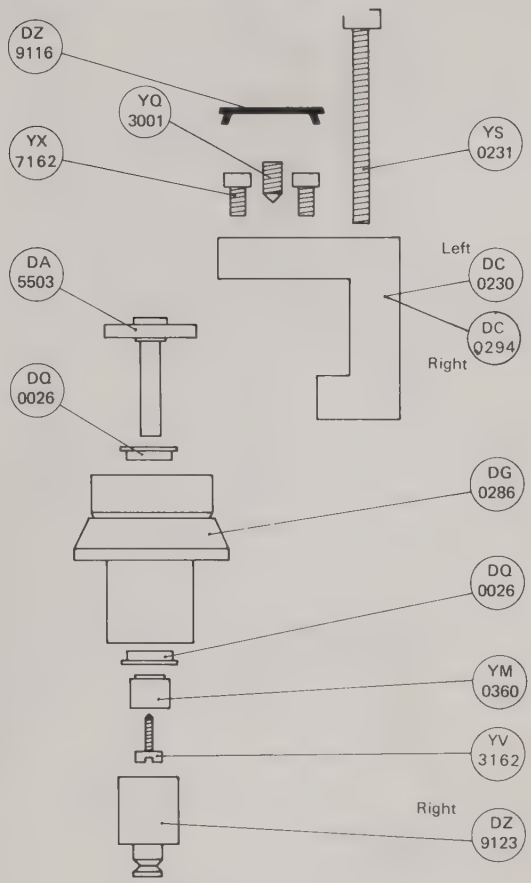
UD 0022 Capstan Unit, left
UD 0023 Capstan Unit, right



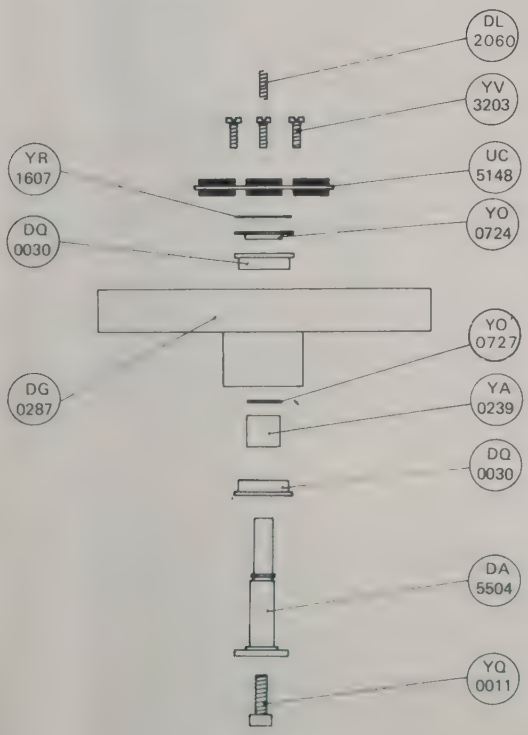
UD 0025 Reel Flange Unit

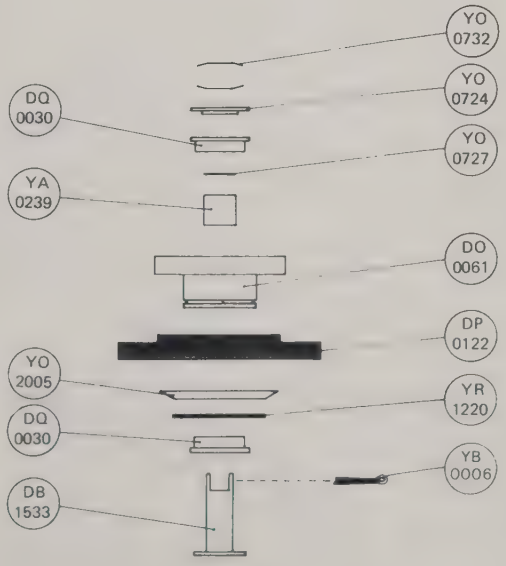


UD 0026 Guide Roller Unit Left
UD 0036 Guide Roller Unit Rigth

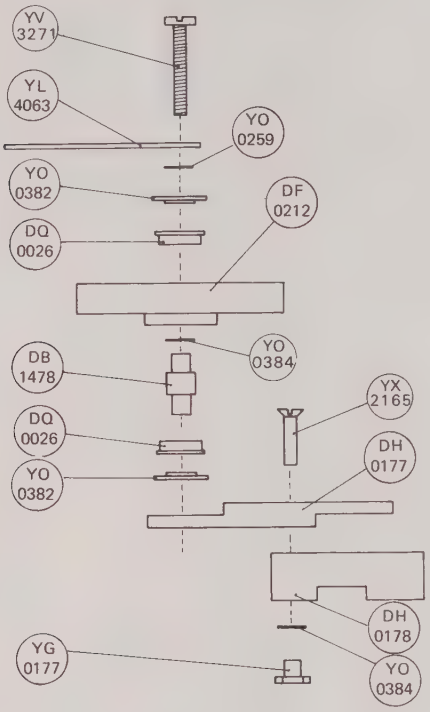


UD 0027' Center Drive Unit

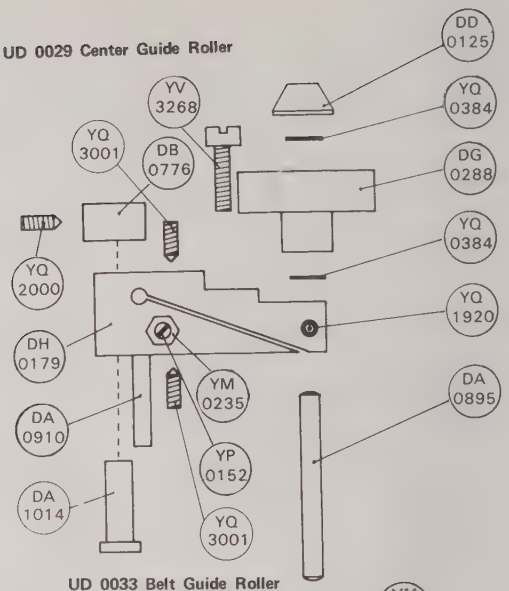




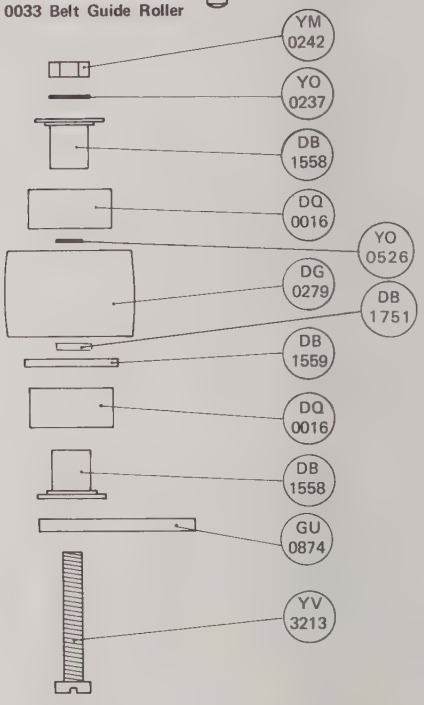
UD 0028 Take-up Idler Unit



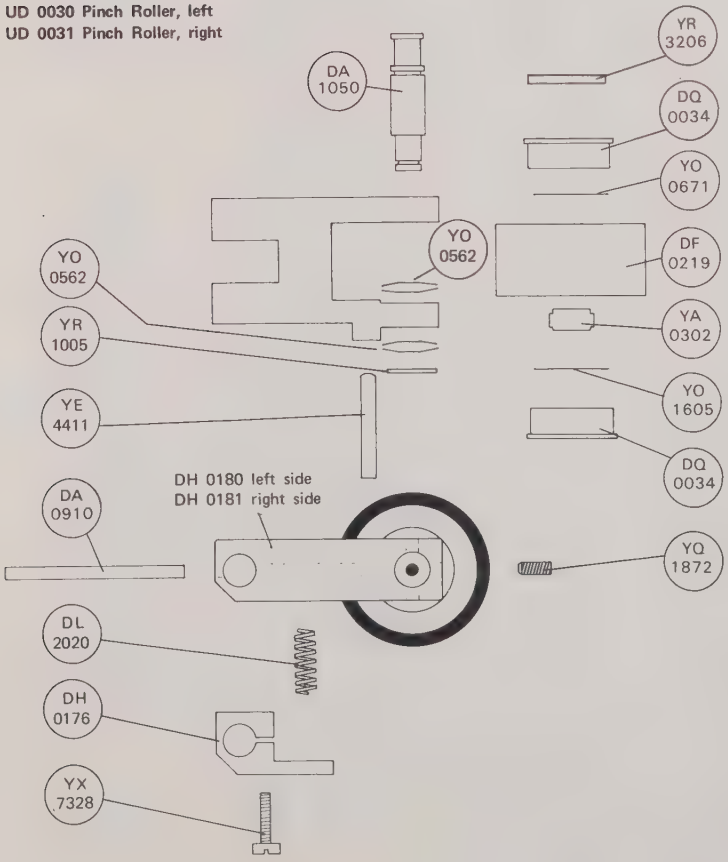
UD 0029 Center Guide Roller



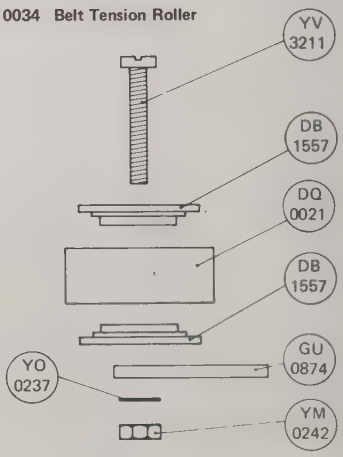
UD 0033 Belt Guide Roller



UD 0030 Pinch Roller, left
UD 0031 Pinch Roller, right



UD 0034 Belt Tension Roller

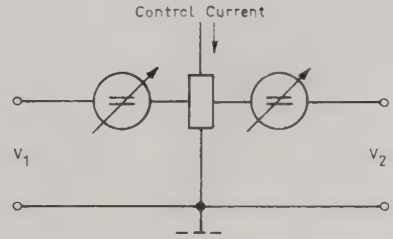


MOTORCIRCUIT

The Tape Transport is driven by a 4-pole DC Motor which is provided with 2 Hall-Generators for speed control purpose.

As can be seen from the equivalent diagram the Hall-Generator can be regarded as two Voltage Generators referring to a resistive element where a control current is passed through. The output from each Voltage Generator is proportional to the magnetic induction of the Hall-Generator while the average voltage of the two generators is proportional to the current through the resistive element.

A cross-magnetized rotor in the 4-pole DC Motor supplies the magnetic induction and the control current is provided by a current generator in Wind mode and by a Tachometer controlled Servo Amplifier in Play/Record mode.



Two Hall-Generators each having two Voltage Generators will now control 4 current supplies energizing the 4 poles of the DC Motor in accordance with the instantaneous position of the rotor as well as the control current.

Adjustments

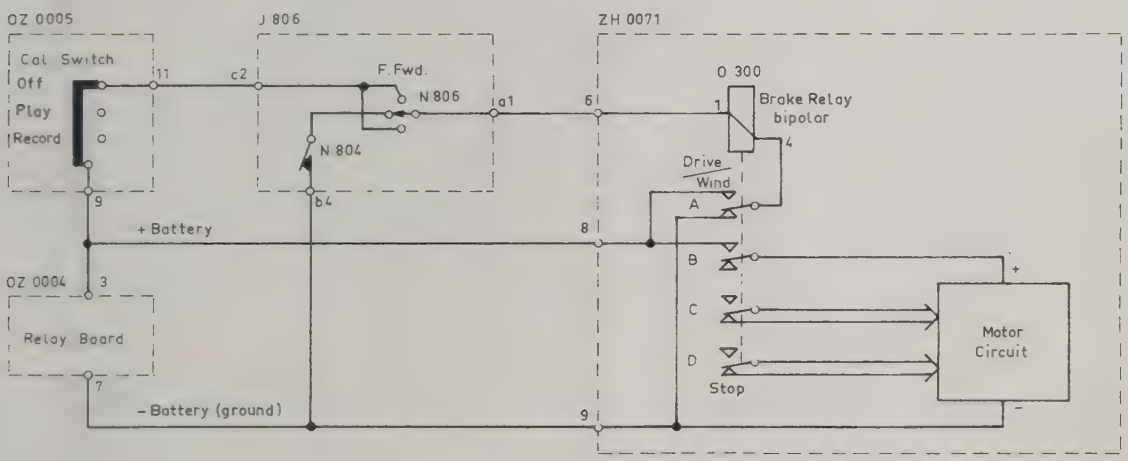
Connect an Oscilloscope across R 305 on the DC Motor Board ZH 0071 and run the Tape Recorder at a speed of 1,5 ips with tape on the machine.

P 301 Bal. should now be adjusted until the half sinewaves are of equal height.

P 300 Wind adjusts the winding speed which is factory adjusted for a "Rewind" and "F. Fwd." time of approx. 5 minutes for 540 m of tape (1800 ft).

A faster winding time can be obtained, but the current consumption during winding will then increase.

WIND



The forward and reverse direction of the winding is arranged mechanically while the Motor Circuit will act in the same way for both directions of winding.

Winding can be started only when the Cal. Switch is in position "Off". N 806 provides + Battery voltage for the Brake Relay O 300 which is a bipolar type of relay. This relay will now switch to the Drive/Wind position and remain there while there will now be + Battery on both ends of the relay coil due to the coupling of the A contact. At the same time the B contact supplies + Battery for the Motor Circuit and the C and D contacts release the braking effect which is a shortcircuit of the coils in the motor.

When N 806 is switched back to to position "O" there will be a reversed voltage across the relay coil and the relay switches back to Stop position, where contact B disconnect + Battery and contacts C and D shortcircuit the motorcoils in order to brake the motor.

Thus the Brake Relay O 300 will have a current consumption only at the instant of switching.

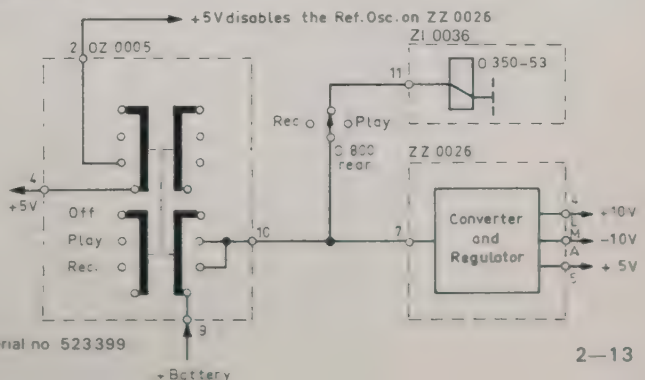
None of the electronic circuits except ZH 0071 will be energized during winding.

CALIBRATION

With Cal. Switch in positions "Play" and "Record" the Converter and Regulator is energized thus providing + 10 V, −10 V and + 5 V for all the electronic circuits except + 5 V for the TTL circuits in the Servo Amplifier.

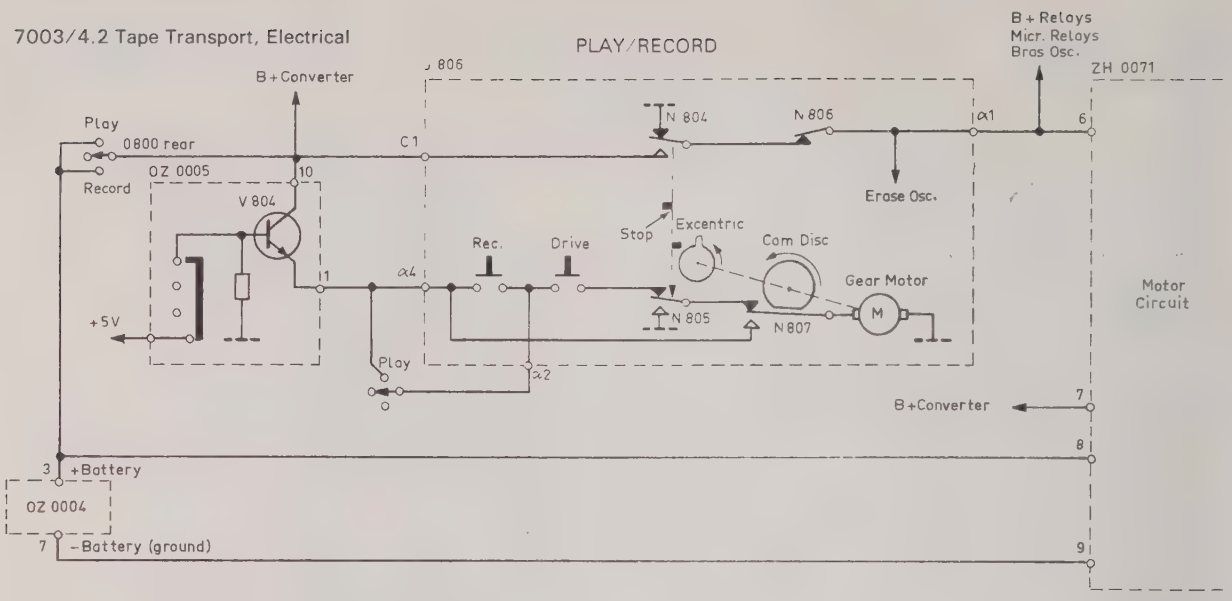
At the same time 4 relays on ZI 0036 are energized through Rec.-Play selector which should be in position "O" when calibrating.

With cal. Switch in position "Record" + 5 V switches off the Ref. Oscillator on ZZ 0026 which also causes that the Demodulator is coupled to receive the Modulator output (see page).



Valid from serial no 523399

PLAY/RECORD



When the Excentric starts moving the Pinch Rollers are pushed towards the Capstans while contacts N 804 and 805 change position. This causes + Battery for the Motor Circuit which starts up in the same way as described under WINDING.

When the Gear Motor has made one complete turn the Cam. Disc. will release N 807 thus causing a shortcircuit across the the Motor which stops.

N 804 and 805 will be released when depressing "Stop" or "Release".

Instead of "Play", the instrument can be in "Record" position where a Recording can be started only when "Rec." is depressed together with "Drive".

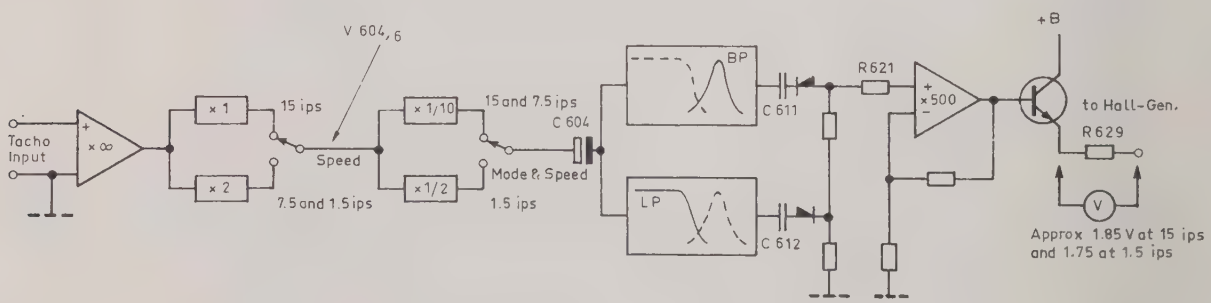
B + Converter to pin 7 on ZH 0071 which is not present during Winding switches off the speed control circuit because the Tachometer controlled Servo Amplifier takes over this function.

When the instrument is switched to Play or Record the positive Battery supply will be connected to the DC converter on ZZ 0026 which now provides + and —10 V as well as + 5 V for the electronic circuits. However in position "Play" the Modulator will not be provided with these voltages due to the coupling through O 800.

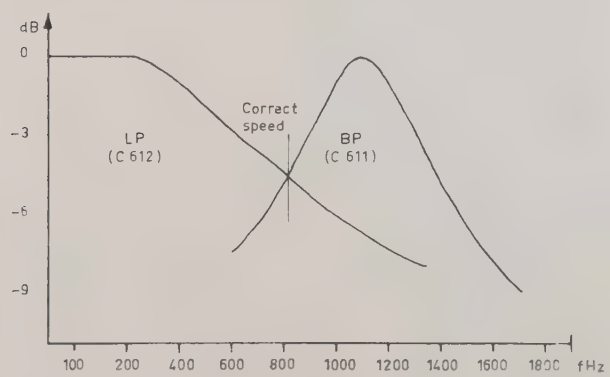
When the Cal. Switch is in "Off" position V 804 has approx. + 4,5 V on the emitter which enables a start of the Motor Circuit in the following way.

By switching to Play (or Record) the Pinch Rollers are positioned in ready position close to the Capstans, but not touching. Now when "Drive" is depressed the + 4,5 V will energize the Gear Motor, the cam. disc. of which provides contact to + 4,5 V through N 807 thus allowing "Drive" to be released

MOTOR SERVO AMPLIFIER



In Play/Record mode the speed of the DC Motor is controlled by a Tachometer and a Servo Amplifier, the principle of which is shown on the simplified diagram



A Tachometer beltdriven by the Motor supplies a number of impulses proportional to speed to the Tacho input of the Servo Amplifier. Here a doubling and dividing takes place dependent of Speed and Mode, and the resulting output of approx. 800 Hz is fed to a Low Pass Filter and a Band Pass Filter

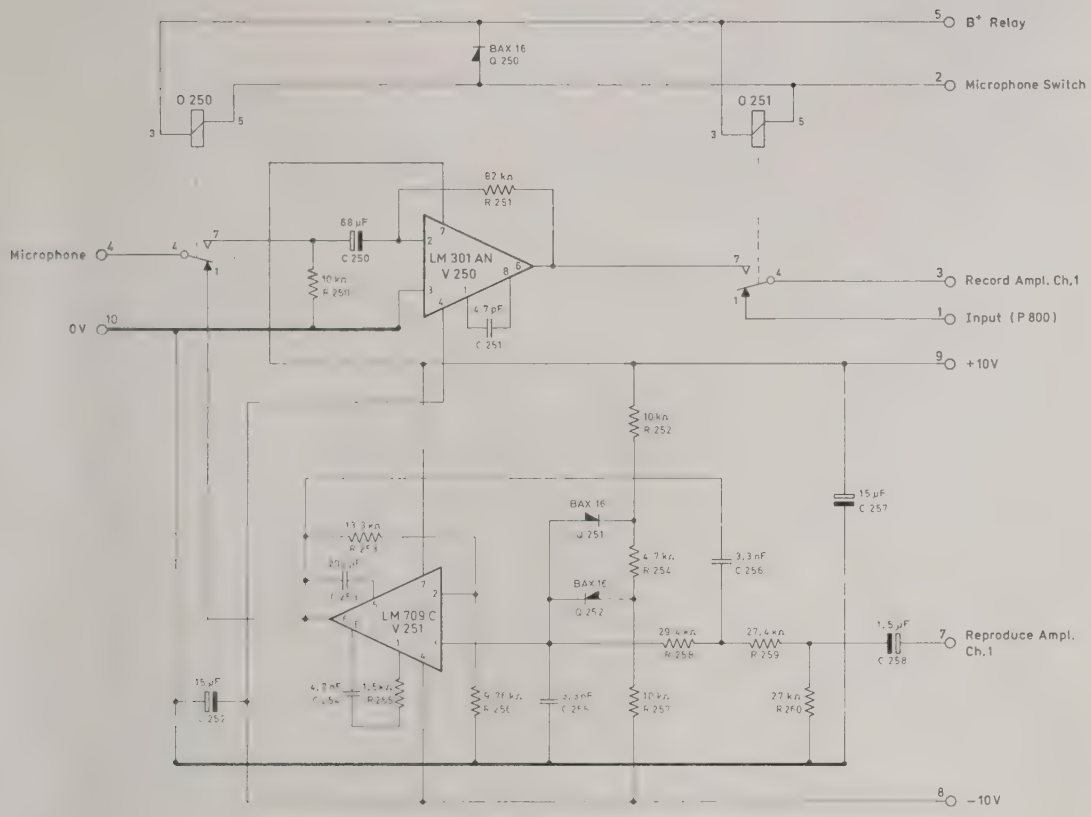
Now if the speed is too low the output from the LP Filter is positive rectified thus producing a larger positive current to the Hall-Generator causing higher speed, and if the speed is too high a negative rectified signal from the BP Filter provides less positive current to the Hall-Generator causing lower speed. The correct speed will be under such a condition that the resulting rectified output from the two filters is just a few mV positive causing a proper supply of current for the Hall-Generator.

For fault tracing the Tachometer should be disconnected and an Oscillator connected instead. Then it should be checked if it is possible to obtain positive as well as negative rectified signal on R 621 by changing frequency around the Filter characteristics. By means of the Oscillator also the Filter characteristics can be checked, and the doubler and divider. A check of the voltage across R 629 ensures whether the resistive element in the Hall-Generator is defective or not.

Circuit and Layout Diagrams with Parts List

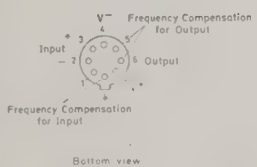
ZE 0079

Microphone Amplifier



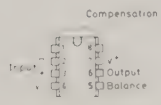
C 250	Tantalum	68 µF/ 3 V		CF 0011
C 251	Ceramic	4.7 pF/400 V		CK 0470
C 252	Tantalum	15 µF/ 20 V		CF 0010
C 253	Polystyrene	200 pF/100 V		CT 1118
C 254	Ceramic	4.7 nF/100 V		CK 0096
C 255,256	Polystyrene	3.3 nF/ 63 V		CT 1544
C 257	Tantalum	15 µF/ 20 V		CF 0010
C 258	-	1.5 µF/ 35 V		CF 0008
Q 250,251	Relay type RS	6 V		OC 0058
Q 250-252	Silicon	150 V/300 mA	BAX 16	QV 0217
R 250	Carbon	1/4 W	5%	10 kΩ RB 4100
R 251	-	-	-	82 kΩ RB 4820
R 252	-	-	-	10 kΩ RB 4100
R 253	Metal	-	1%	13.3 kΩ RF 4133
R 254	Carbon	-	5%	4.7 kΩ RB 3470
R 255	-	-	-	1.5 kΩ RB 3150
R 256	Metal	-	1%	9.76 kΩ RF 3976
R 257	Carbon	-	5%	10 kΩ RB 4100
R 258	Metal	-	1%	29.4 kΩ RF 4294
R 259	-	-	-	27.4 kΩ RF 4274
R 260	Carbon	-	5%	27 kΩ RB 4270
V 250	Op. Ampl.			LM 301 AN VE 0017
V 251	-			LM 709 CH VE 0003
	Printed Circuit Board			XC 0905

LM 709 C



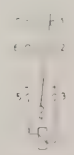
Bottom view

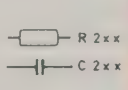
LM 301 AN

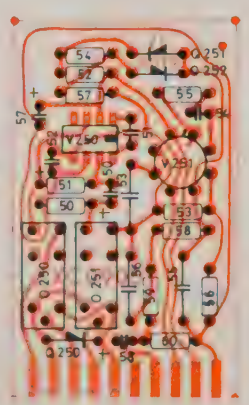


Top view

Relay Connections





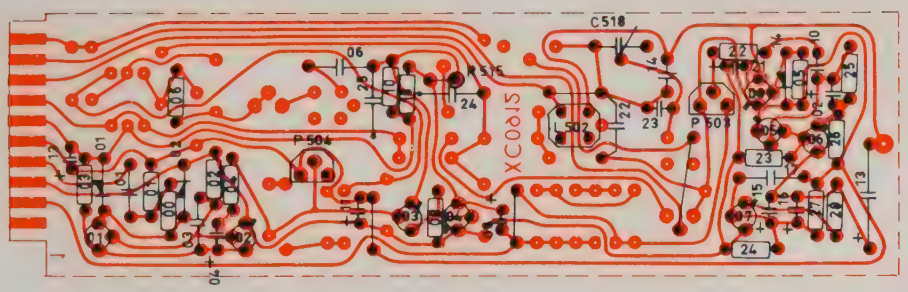


viewed from the printed circuit side

Circuit and Layout Diagrams with Parts List

ZE 0189

Record Amplifier



viewed from the component side

C 501	Polyester	0,1 µF/100 V	CS 0409
C 502	Ceramic	82 pF/400 V	CK 1820
C 503	Polystyrene	200 pF/100 V	CT 1118
C 504	Tantalum	15 µF/ 20 V	CF 0010
C 506	Polystyrene	680 pF/125 V	CT 1134
C 508	Tantalum	47 µF/ 6,3 V	CF 0023
C 510-512		15 µF/ 20 V	CF 0010
C 513	Electrolytic	100 µF/ 6,3 V	CE 0207
C 514	Ceramic	820 pF/125 V	CT 1532
C 515,516	Tantalum	100 µF/ 3 V	CF 0019
C 517	Polystyrene	510 pF/125 V	CT 1135
C 518	Variable	10-60 pF/160 V	CV 0032
C 521	Tantalum	15 µF/ 20 V	CF 0010
C 522	Polystyrene	1,8 nF/125 V	CT 1127
C 523	Ceramic	Selected to MR 0019	
C 524,525	Polystyrene	680 pF/125 V	CT 1134

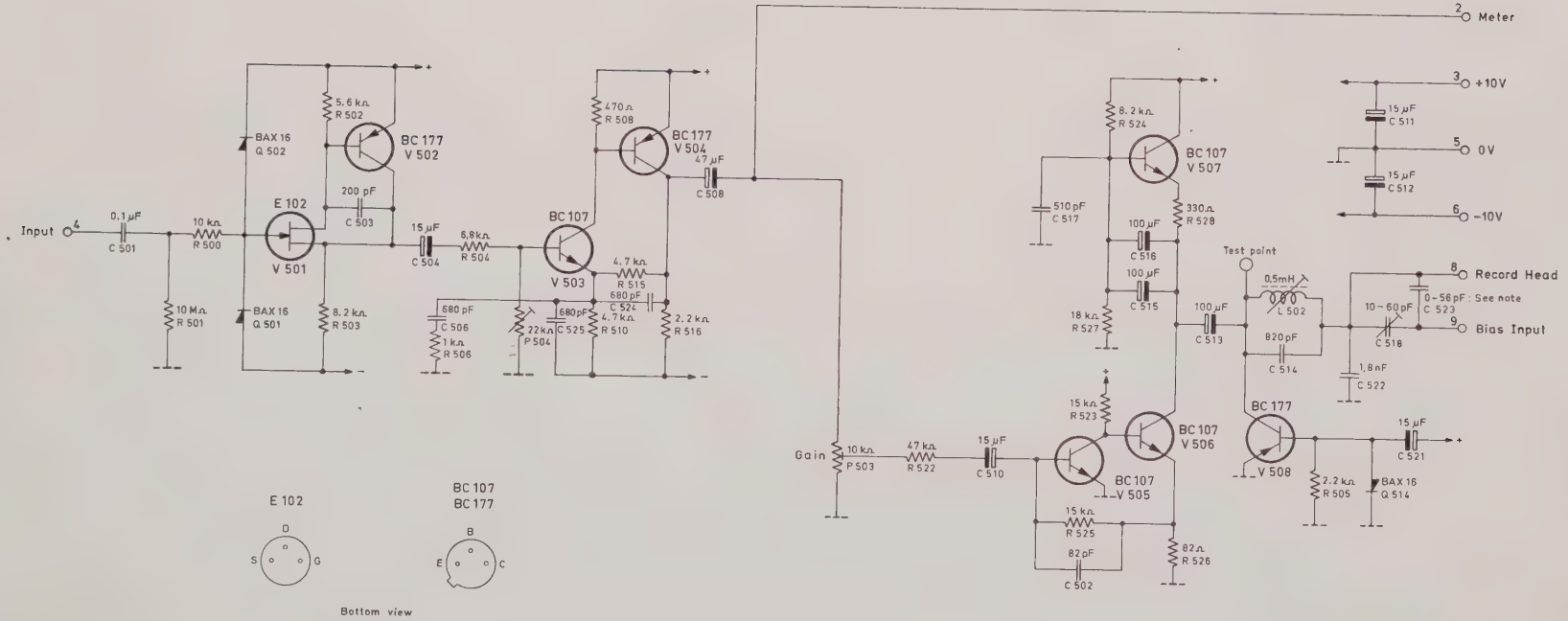
L 502	Coil for Bias Trap	0,5 mH	LB 0890
P 503	Trimmer	10 kΩ	PG 3110
P 504		22 kΩ	PG 3220

Q 501,502	Silicon BAX 16	150 V/300 mA	QV 0217

R 502	Carbon	1/4 W	5%	5,6 kΩ	RB 3560
R 503	·	·	·	8,2 kΩ	RB 3820
R 504	·	·		6,8 kΩ	RB 3680
R 505	·	·		2,2 kΩ	RB 3220
R 506	·	·	·	1 kΩ	RB 3100
R 508	·	·	·	470 Ω	RB 2470
R 510	·	·		4,7 kΩ	RB 3470
R 515	·	·		4,7 kΩ	RB 3470
R 516	·			2,2 kΩ	RB 3220
R 522	·	·		47 kΩ	RB 4470
R 523	·	·		15 kΩ	RB 4150
R 524	·		·	8,2 kΩ	RB 3820
R 525	·	·		15 kΩ	RB 4150
R 526	·	·		82 Ω	RB 1820
R 527	·	·		18 kΩ	RB 4180
R 528	·	·		330 Ω	RB 2330

V 501	FET	N	E 102	VB 1009
V 502	Silicon	PNP	BC 177	VB 0071
V 503	·	NPN	BC 107	VB 0032
V 504	·	PNP	BC 177	VB 0071
V 505-507	·	NPN	BC 107	VB 0032
V 508	·	PNP	BC 177	VB 0071

Printed Circuit Board		XC 0912



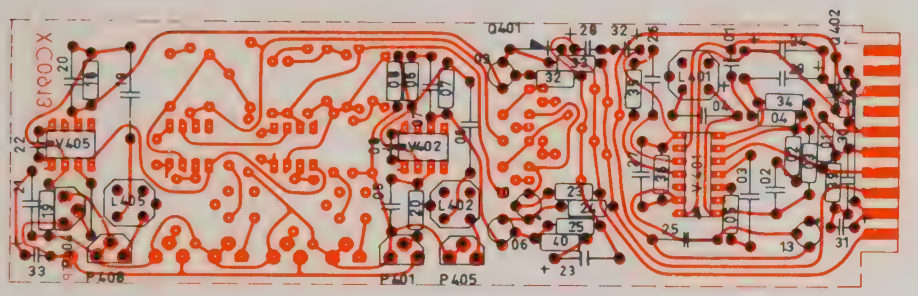
Note : C 523 depens on Record Head,
MR 0019 : 22 - 56 pF
MR 0025 : 0 pF i.e. C 523 omitted

Circuit and Layout Diagrams with Parts List

ZE 0190

Reproduce Amplifier

R 4xx
C 4xx
V 4xx



viewed from the component side

C 401	Tantalum	68 µF/ 3 V	CF 0011
C 402	Polyester	68 nF/100 V	CS 0392
C 403	Polystyrene	5,1 nF/ 63 V	CT 1124
C 404	-	1 nF/ 63 V	CT 1132
C 405	-	50 pF/ 63 V	CT 1530
C 406	-	8,2 nF/ 63 V	CT 1556
C 407	-	10 nF/ 30 V	CT 1552
C 408	Ceramic	10 pF/400 V	CK 1100
C 419	Polystyrene	31,6 nF/ 63 V	CT 1548
C 420	-	680 pF/125 V	CT 1134
C 421	-	100 pF/125 V	CT 1133
C 422	Ceramic	15 pF/400 V	CK 1150
C 423	Tantalum	1 µF/ 35 V	CF 0062
C 424	Electrolytic	47 µF/ 10 V	CE 0204
C 425	Polystyrene	680 pF/125 V	CT 1134
C 426	-	10 nF/ 30 V	CT 1552
C 427	Ceramic	70 pF/400 V	CK 0092
C 428	Tantalum	15 µF/ 20 V	CF 0010
C 429	Electrolytic	47 µF/ 10 V	CE 0204
C 430	Polystyrene	680 pF/125 V	CT 1134
C 431	Tantalum	33 µF/ 10 V	CF 0034
C 432,433	-	15 µF/ 20 V	CF 0010

R 401	Metal	1/4 W	1%	100 kΩ	RF 5100
R 402	-	-	-	2,67 kΩ	RF 3267
R 403	-	-	-	243 kΩ	RF 5243
R 404	-	-	-	100 Ω	RF 2100
R 405	Carbon	-	5%	56 Ω	RB 1560
R 406	Metal	-	1%	1,05 kΩ	RF 3105
R 407	-	-	-	15,8 kΩ	RF 4158
R 408	-	-	-	787 Ω	RF 2787
R 408	-	-	-	1330 Ω	RF 3133
R 418	-	-	-	38,3 kΩ	RF 4383
R 419	-	-	-	1,02 kΩ	RF 3102
R 420	Carbon	-	5%	22 kΩ	RB 4220
R 423,424	-	-	-	47 kΩ	RB 4470
R 425	Metal	-	1%	4,42 kΩ	RF 3442
R 432	-	-	-	2,32 kΩ	RF 3232
R 433	Carbon	-	5%	47 kΩ	RB 4470
R 434	-	-	-	150 Ω	RB 2150
R 435	-	-	-	33 Ω	RB 1330
R 436	Metal	-	1%	30,9 kΩ	RF 4309
R 439	Carbon	-	5%	2,2 kΩ	RB 3220
R 440	Metal	-	1%	2,21 kΩ	RF 3221
R 442	-	-	-	22 kΩ	RB 4220

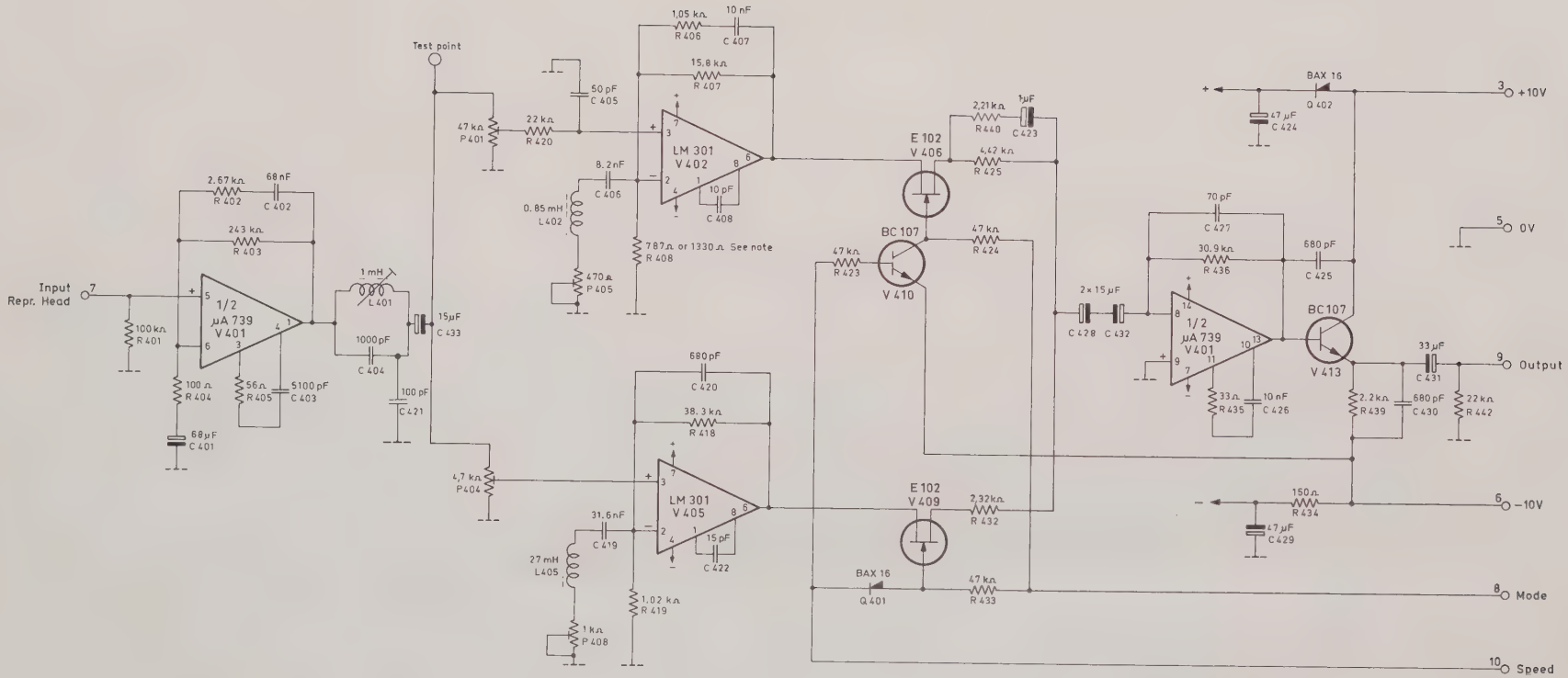
L 401	Coil	1 mH	LB 0825
L 402	-	0,85 mH	LB 0827
L 405	-	27 mH	LB 0828

V 401	Op.Amp.		µA 739 C	VE 1003
V 402	-		LM 301 AN	VE 0017
V 405	-		LM 301 AN	VE 0017
V 406	FET	N	E 102	VB 1009
V 409	-	N	E 102	VB 1009
V 410	Silicon	NPN	BC 107	VB 0032
V 413	-	NPN	BC 107	VB 0032

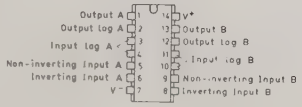
P 401	Trimmer	Cermet	lin.	47 kΩ	PG 3470
P 404	-	-	-	4,7 kΩ	PG 2471
P 405	-	-	-	470 Ω	PG 1471
P 408	-	-	-	1 kΩ	PG 2109

Printed Circuit Board XC 0913

Q 401,402	Silicon	BAX 16	150 V/300 mA	QV 0217

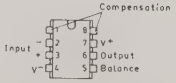


µA 739



Top view

LM 301



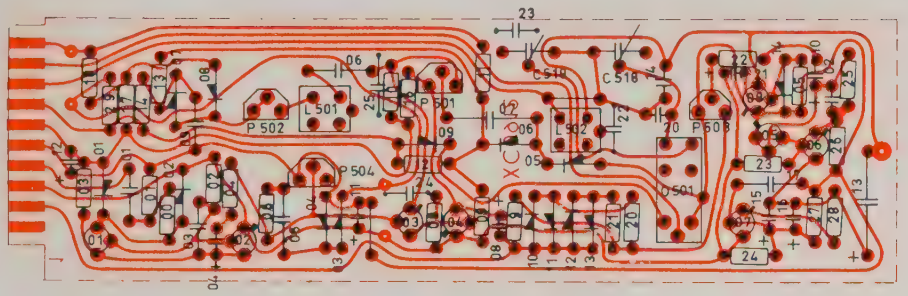
E 102

BC 107

Bottom view

Note: R 408 depends on Reproduce Head
MR 0020: 1330 Ω
MR 0026: 787 Ω

Circuit and Layout Diagrams with Parts List



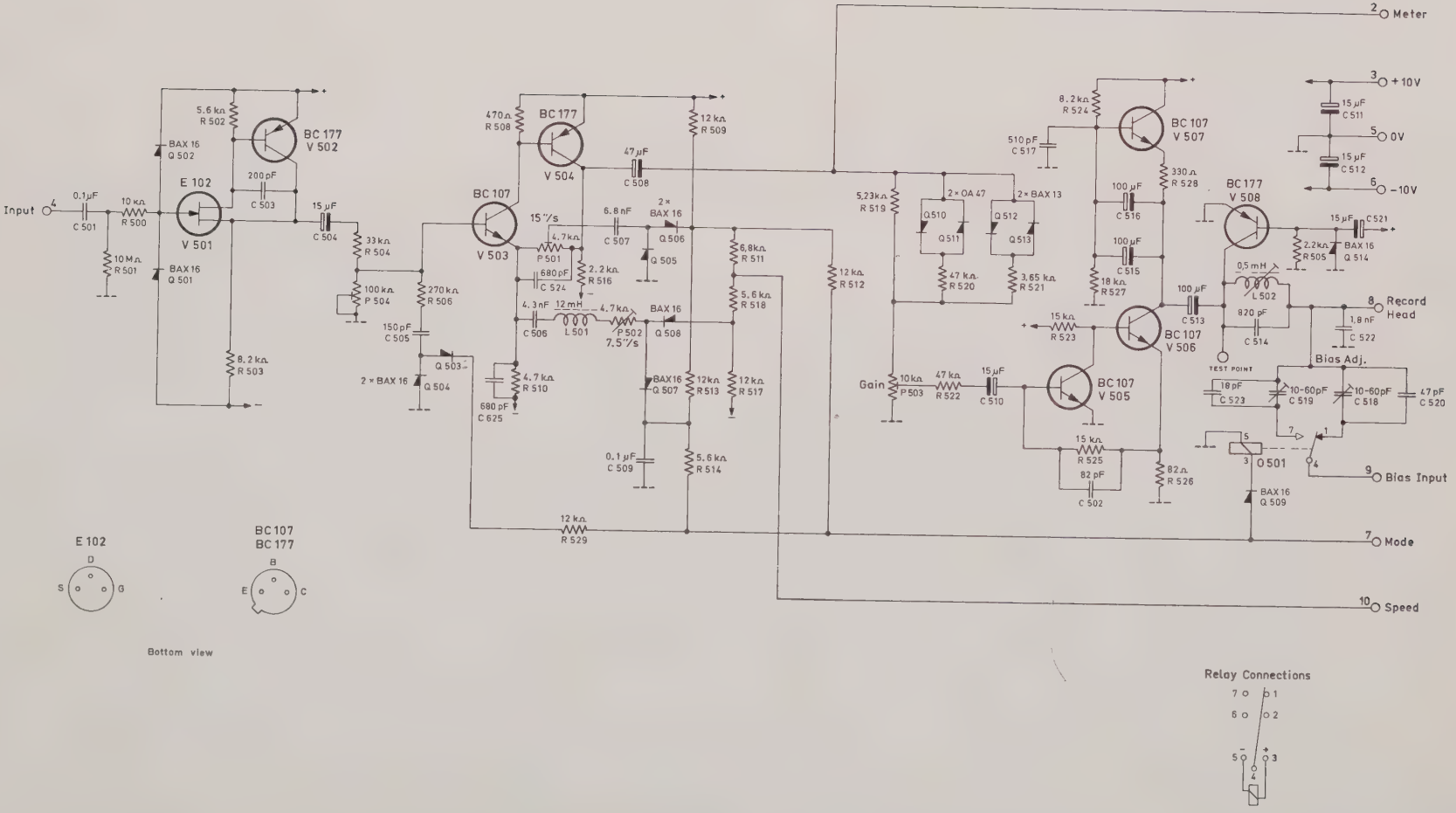
viewed from the component side

C 501	Polyester	0.1 µF/100 V	CS 0409	
C 502	Ceramic	82 pF/400 V	CK 1820	
C 503	Polystyrene	200 pF/100 V	CT 1118	
C 504	Tantalum	15 µF/ 20 V	CF 0010	
C 505	Polystyrene	150 pF/125 V	CT 1139	
C 506	"	4.3 nF/ 63 V	CT 1178	
C 507	"	6.8 nF/ 63 V	CT 1511	
C 508	Tantalum	47 µF/ 6.3 V	CF 0023	
C 509	Polycarbonate	0.1 µF/100 V	CS 0409	
C 510-512	Tantalum	15 µF/ 20 V	CF 0010	
C 513	Electrolytic	100 µF/ 6.3 V	CE 0207	
C 514	Polystyrene	820 pF/63 V	CT 1532	
C 515,516	Tantalum	100 µF/ 3 V	CF 0019	
C 517	Polystyrene	510 pF/125 V	CT 1135	
C 518,519	Trimmer	10- 60 pF/160 V	CV 0032	
C 520	Ceramic	47 pF/400 V	CK 1470	
C 521	Tantalum	15 µF/ 20 V	CF 0010	
C 522	Polystyrene	1,8 nF/ 63 V	CT 1127	
C 523	Ceramic	18 pF/400 V	CK 1180	
C 524, 525	Polystyrene	680 pF/ 63 V	CT 1134	
L 501		12 mH	LB 0829	
L 502		0,5 mH	LB 0890	
O 501	Relay	Type RS - 12 V	OC 0059	
P 501,502	Trimmer	4.7 kΩ	PG 2471	
P 503		10 kΩ	PG 3110	
P 504		100 kΩ	PG 4107	
Q 501-509	Silicon	150 V/300 mA	BAX 16	QV 0217
Q 510,511	Germanium	25 V/110 mA	OA 47	QV 0094
Q 512,513	Silicon	50 V/150 mA	BAX 13	QV 0223
Q 514		150 V/300 mA	BAX 16	QV 0217
R 500	Carbon	1/4 W 5%	10 kΩ	RB 4100
R 501		1/8 W 10%	10MΩ	RA 0025
R 502		1/4 W 5%	5.6 kΩ	RB 3560

R 503	Carbon	1/4 W	5%	8.2 kΩ	RB 3820
R 504	"	"	"	33 kΩ	RB 4330
R 505	"	"	"	2.2 kΩ	RB 3220
R 506	"	"	"	270 kΩ	RB 5260
R 508	"	"	"	470 Ω	RB 2470
R 509	"	"	"	12 kΩ	RB 4120
R 510	"	"	"	4.7 kΩ	RB 3470
R 511				6,8 kΩ	RB 3680
R512,513		"	"	12 kΩ	RB 4120
R 514	"	"	"	5.6 kΩ	RB 3560
R 516	"	"	"	2.2 kΩ	RB 3220
R 517	"	"	"	12 kΩ	RB 4120
R 518	"	"	"	5.6 kΩ	RB 3560
R 519	Metal	"	1%	5,23 kΩ	RF 3523
R 520	Carbon	"	5%	47 kΩ	RB 4470
R 521	Metal	"	1%	3,65 kΩ	RF 3365
R 522	Carbon	"	5%	47 kΩ	RB 4470
R 523	"	"	"	15 kΩ	RB 4150
R 524	"	"	"	8.2 kΩ	RB 3820
R 525	"	"	"	15 kΩ	RB 4150
R 526	"	"	"	82 Ω	RB 1820
R 527	"	"	"	18 kΩ	RB 4180
R 528	"	"	"	330 Ω	RB 2330
R 529	"	"	"	12 kΩ	RB 4120

V 501	FET	N-channel	E 102	VB 1009
V 502	Si. trans.	PNP	BC 177	VB 0071
V 503	"	NPN	BC 107	VB 0032
V 504	"	PNP	BC 177	VB 0071
V 505-507	"	NPN	BC 107	VB 0032
V 508	"	PNP	BC 177	VB 0071

Printed Circuit Board	XC 0912



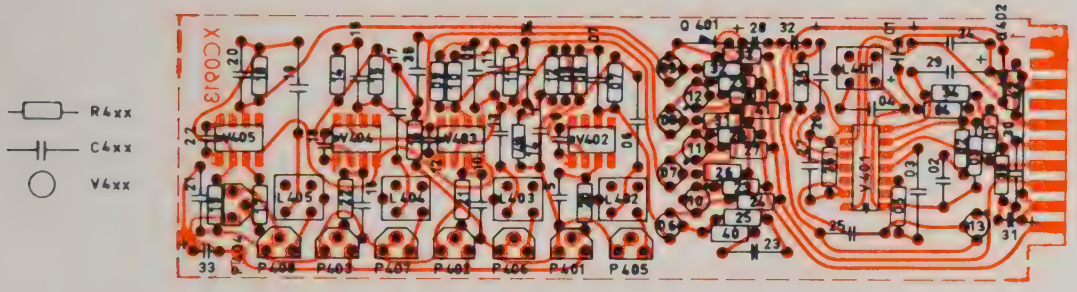
E 102

BC 107
BC 177

Bottom view

Relay Connections

Circuit and Layout Diagrams with Parts List



viewed from the component side

C 401	Tantalum	100 µF/ 3 V	CF 0019
C 402	Polyester	0.1 µF/100 V	CS 0409
C 403	Polystyrene	5.1 nF/ 63 V	CT 1124
C 404	·	1 nF/ 63 V	CT 1132
C 405	·	50 pF/ 63 V	CT 1530
C 406	·	8.2 nF/ 63 V	CT 1556
C 407	·	10 nF/ 30 V	CT 1552
C 408	Ceramic	10 pF/400 V	CK 1100
C 409	Polystyrene	3 nF/ 30 V	CT 1157
C 410	·	150 pF/125 V	CT 1139
C 411	Polycarbonate	68 nF/100 V	CS 0392
C 412	Ceramic	15 pF/400 V	CK 1150
C 413	Polystyrene	4 nF/ 63 V	CT 1536
C 414	Tantalum	0,47 µF/ 35 V	CF 0027
C 415	Polystyrene	3 nF/ 30 V	CT 1157
C 416	·	150 pF/125 V	CT 1139
C 417	·	4.3 nF/ 63 V	CT 1178
C 418	Ceramic	15 pF/400 V	CK 1150
C 419	Polystyrene	31.6 nF/ 63 V	CT 1548
C 420	Polystyrene	680 pF/125 V	CT 1134
C 421	·	100 pF/125 V	CT 1133
C 422	Ceramic	15 pF/400 V	CK 1150
C 423	Tantalum	0,68 µF/ 35 V	CF 0044
C 424	Electrolytic	47 µF/ 10 V	CE 0204
C 425	Polystyrene	680 pF/125 V	CT 1134
C 426	·	10 nF/ 30 V	CT 1552
C 427	Ceramic	70 pF/400 V	CK 0092
C 428	Tantalum	15 µF/ 20 V	CF 0010
C 429	Electrolytic	47 µF/ 10 V	CE 0204
C 430	Polystyrene	680 pF/125 V	CT 1134
C 431	Tantalum	33 µF/ 10 V	CF 0034
C 432,433	·	15 µF/ 20 V	CF 0010
C 434,435	Polystyrene	510 pF/125 V	CT 1131

L 401		1 mH	LB 0825
L 402		0.85 mH	LB 0827
L 403,404		12 mH	LB 0829
L 405		27 mH	LB 0828

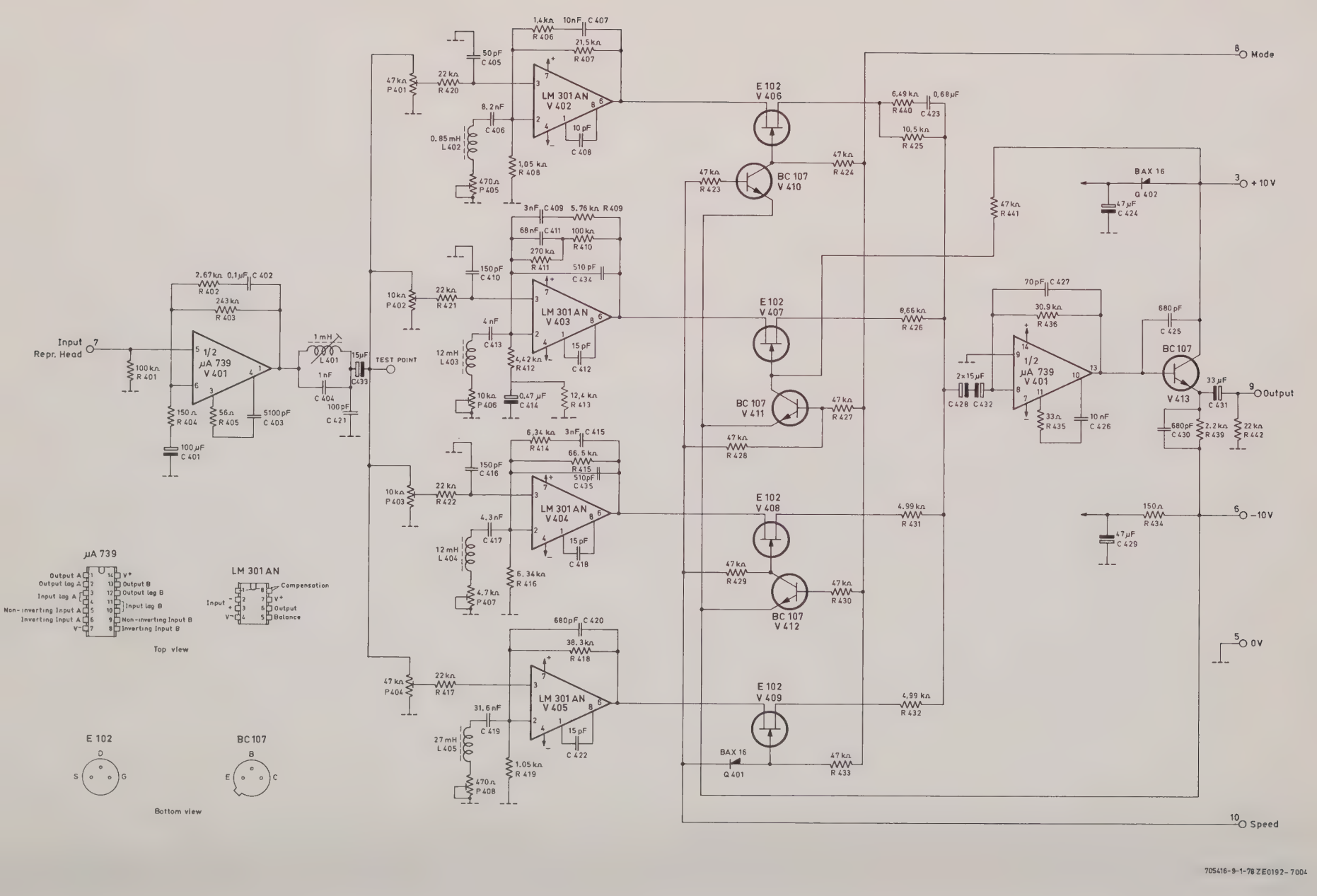
P 401	Trimmer	47 kΩ	PG 3470
P 402,403	·	10 kΩ	PG 3110
P 404	·	47 kΩ	PG 3470
P 405	·	470 Ω	PG 1471
P 406	·	10 kΩ	PG 3110
P 407	·	4.7 kΩ	PG 2471
P 408		470 Ω	PG 1471

Q 401,402	Silicon	150 V/300 mA	BAX 16	QV 0217

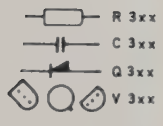
R 401	Metal	1/4 W	1%	100 kΩ	RF 5100
R 402	·	·	·	2.67 kΩ	RF 3267
R 403	·	·	·	243 kΩ	RF 5243
R 404	·	·	·	150 Ω	RF 2150
R 405	Carbon	·	5%	56 Ω	RB 1560
R 406	Metal	·	1%	1,4 kΩ	RF 3140
R 407	·	·	·	21,5 kΩ	RF 4215
R 408	·	·	·	1,05 kΩ	RF 3105
R 409	·	·	·	5.76 kΩ	RF 3576
R 410	·	·	·	100 kΩ	RF 5100
R 411	Carbon	·	5%	270 kΩ	RB 5270
R 412	Metal	·	1%	4,42 kΩ	RF 3442
R 413	·	·	·	12,4 kΩ	RF 4124
R 414	·	·	·	6,34 kΩ	RF 3634
R 415	·	·	·	66.5 kΩ	RF 4665
R 416	·	·	·	6.34 kΩ	RF 3634
R 417	Carbon	·	5%	22 kΩ	RB 4220
R 418	Metal	·	1%	38.3 kΩ	RF 4383
R 419	·	·	·	1.05 kΩ	RF 3105
R 420-422	Carbon	·	5%	22 kΩ	RB 4220
R 423,424	·	·	·	47 kΩ	RB 4470
R 425	Metal	·	1%	10,5 kΩ	RF 4105
R 426	·	·	·	8,66 kΩ	RF 3866
R 427-430	Carbon	·	5%	47 kΩ	RB 4470
R 431	Metal	·	1%	4.99 kΩ	RF 3499
R 432	·	·	·	4,99 kΩ	RF 3499
R 433	Carbon	·	5%	47 kΩ	RB 4470
R 434	·	·	·	150 Ω	RB 2150
R 435	·	·	·	33 Ω	RB 1330
R 436	Metal	·	1%	30.9 kΩ	RF 4309
R 439	Carbon	·	5%	2.2 kΩ	RB 3220
R 440	Metal	·	1%	6,49 kΩ	RF 3649
R 441	Carbon	·	5%	47 kΩ	RB 4470
R 442	·	·	·	22 kΩ	RB 4220

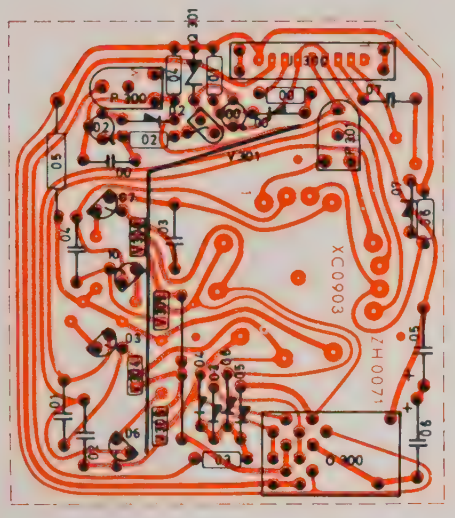
V 401	Op. Amp.		µA 739 C	VE 1002
V 402-405	Op. Amp.		LM 301 AN	VE 0044
V 406-409	FET	N	E 102	VB 1009
V 410-413	Silicon	NPN	BC 107	VB 0032

Printed Circuit Board	XC 0913


Input
Repr. Head
7
100 kΩ R 401
2.67 kΩ R 402
0.1 µF C 402
243 kΩ R 403
1/2 µA 739 V 401
150 Ω R 404
56 Ω R 405
5100 pF C 403
100 µF C 401
1 mH L 401
1 nF C 404
15 µF C 433
100 pF C 421
TEST POINT
1.4 kΩ R 406
10 nF C 407
21.5 kΩ R 407
50 pF C 405
47 kΩ P 401
22 kΩ R 420
8.2 nF C 406
0.85 mH L 402
10 pF C 408
1.05 kΩ R 408
470 Ω P 405
LM 301 AN V 402
3 nF C 409
5.76 kΩ R 409
68 nF C 411
100 kΩ R 410
270 kΩ R 411
150 pF C 410
510 pF C 434
10 kΩ P 402
22 kΩ R 421
4 nF C 413
12 mH L 403
4.42 kΩ R 412
15 pF C 412
10 kΩ P 406
0.47 µF C 414
12.4 kΩ R 413
LM 301 AN V 403
6.34 kΩ R 414
3 nF C 415
66.5 kΩ R 415
510 pF C 435
150 pF C 416
10 kΩ P 403
22 kΩ R 422
4.3 nF C 417
12 mH L 404
6.34 kΩ R 416
4.7 kΩ P 407
15 pF C 418
LM 301 AN V 404
680 pF C 420
38.3 kΩ R 418
47 kΩ P 404
22 kΩ R 417
31.6 nF C 419
27 mH L 405
1.05 kΩ R 419
470 Ω P 408
15 pF C 422
LM 301 AN V 405
E 102 V 406
E 102 V 407
E 102 V 408
E 102 V 409
BC 107 V 410
BC 107 V 411
BC 107 V 412
47 kΩ R 423
47 kΩ R 424
6.49 kΩ R 440
0.68 µF C 423
10.5 kΩ R 425
8.66 kΩ R 426
47 kΩ R 427
47 kΩ R 428
4.99 kΩ R 431
47 kΩ R 429
47 kΩ R 430
4.99 kΩ R 432
BAX 16 Q 401
47 kΩ R 433
47 kΩ R 441
BAX 16 Q 402
47 µF C 424
70 pF C 427
30.9 kΩ R 436
680 pF C 425
2×15 µF C 428 C 432
1/2 µA 739 V 401
33 Ω R 435
10 nF C 426
BC 107 V 413
33 µF C 431
680 pF C 430
2.2 kΩ R 439
22 kΩ R 442
150 Ω R 434
47 µF C 429
8 Mode
3 + 10 V
6 −10 V
5 0 V
9 Output
10 Speed
µA 739
Output A
Output lag A
Input lag A
Non-inverting Input A
Inverting Input A
V−
V+
Output B
Output lag B
Input lag B
Non-inverting Input B
Inverting Input B
Top view
LM 301 AN
Input
Compensation
V+
Output
Balance
E 102
BC 107
Bottom view
705416-9-1-78 ZE0192-7004

Circuit and Layout Diagrams with Parts List





viewed from the printed circuit side

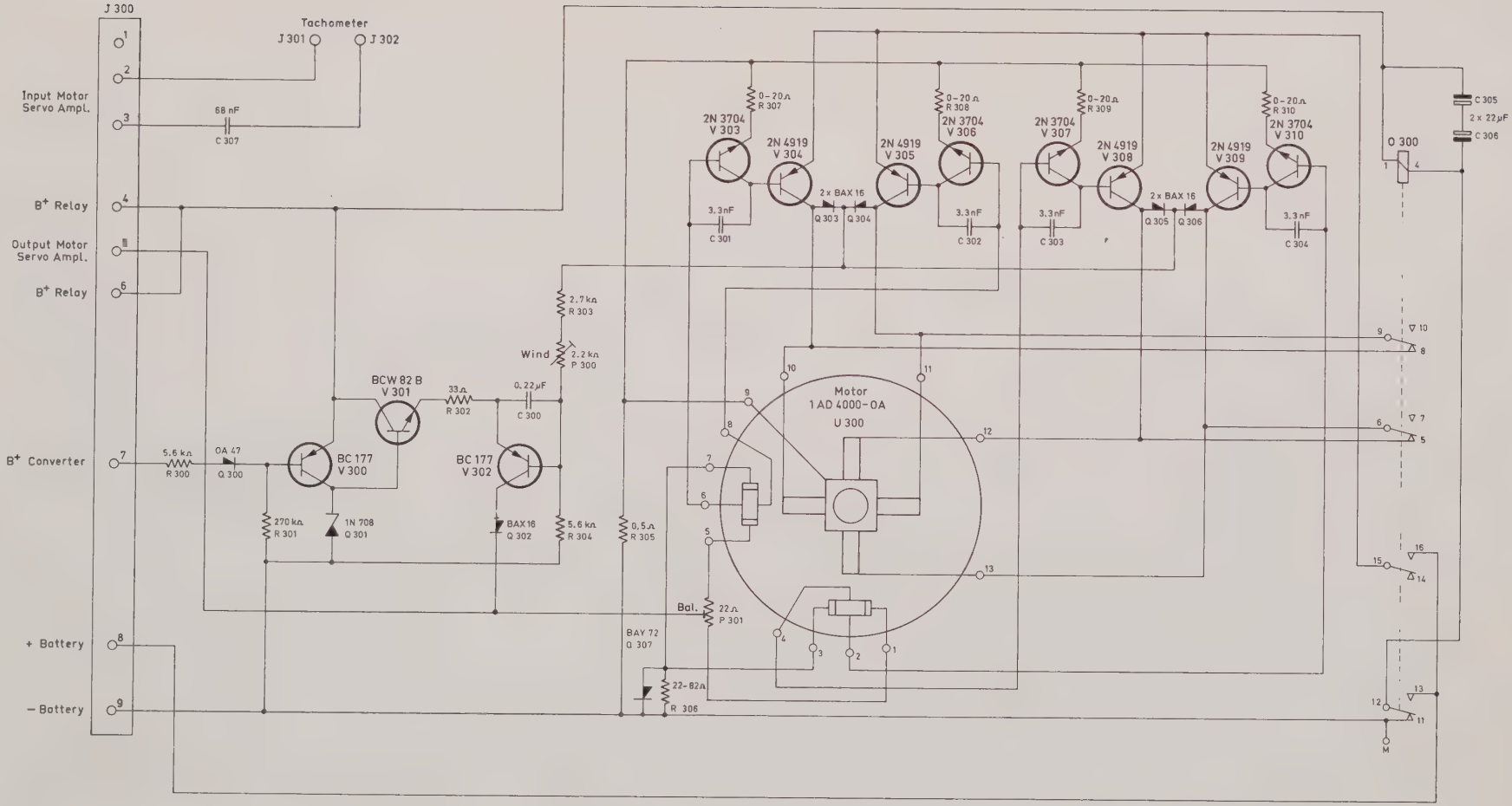
C 300	Polycarbonate	0.22 µF/100 V		CS 0389
C 301-304	Polystyrene	3.3 nF/ 63 V		CT 1544
C 305,306	Electrolytic	22 µF/ 10 V		CE 0203
C 307	Polycarbonate	68 nF/100 V		CS 0392
J 300	Multiplug, 9 pin			JP 0903
J 301,302	Single Pole Connector			JP 0104
O 300	Relay	4.5-9.8 V		OC 0047
P 300	Trimmer	Cermet	lin.	2.2 kΩ	PG 2207
P 301	-	-	-	22 Ω	PG 0222
Q 300	Germanium	25 V/110 mA		OA 47	QV 0094
Q 301	Zener	5.0-6.2 V/ 0.4 W		1N708	QV 1105
Q 302-306	Silicon	150 V/300 mA		BAX 16	QV 0217
Q 307	-	100 V/225 mA		BAY 72	QV 0219

R 300	Carbon	1/4 W	5%	5.6 kΩ	RB 3560
R 301	-	-	-	270 kΩ	RB 5270
R 302	-	-	-	33 Ω	RB 1330
R 303	-	-	-	2.7 kΩ	RB 3270
R 304	-	-	-	5.6 kΩ	RB 3560
R 305	Wire	1 W	10%	0.5 Ω	RO 1203
R 306	Metal	1/4 W	5%	22·82 Ω	
R 307-310	Carbon	-	-	0-20 Ω	

V 300	Silicon	PNP	BC 177	VB 0071
V 301	-	NPN	2 N 4287	VB 0055
V 302	-	PNP	BC 177	VB 0071
V 303	-	NPN	2 N 3704	VB 0028
V 304,305	-	PNP	2 N 4919	VB 0061
V 306,307	-	NPN	2 N 3704	VB 0028
V 308,309	-	PNP	2 N 4919	VB 0061
V 310	-	NPN	2 N 3704	VB 0028

Printed Circuit Board	XC 0903
Motor Board complete with motor	UM 0057

ZH 0071
7003/4 from serial no 523399



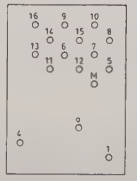
BC177

Bottom view

BCW 82 B

2N 3704

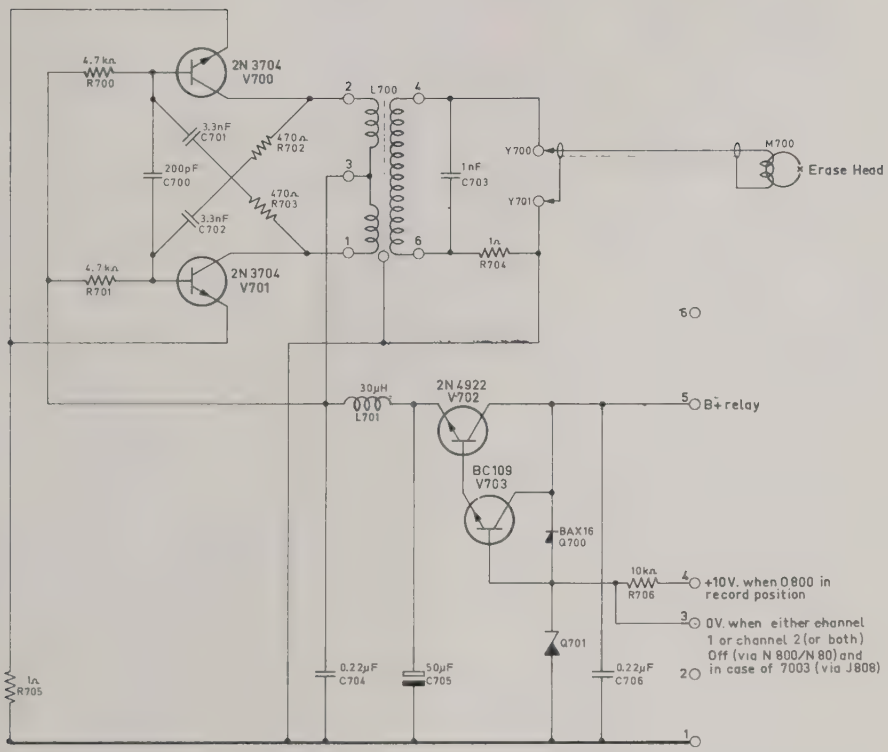
2N 4919



Relay Connections
Bottom view

560347-30.05.75-ZH 0071-7003
523399 " " – " -7004

Circuit and Layout Diagrams with Parts List



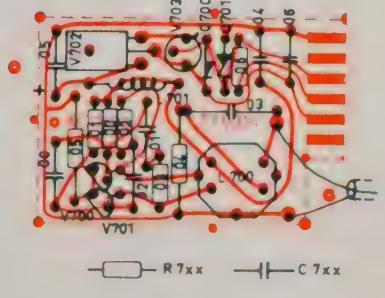
C 700	Polystyrene	200 pF/100 V		CT 1118
C 701,702	-	3.3 nF/ 63 V		CT 1544
C 703	-	1 nF/500 V		CT 1307
C 704	Polyester	0.22 µF/100 V		CS 0389
C 705	Electrolytic	50 µF/ 6.4 V		CE 0204
C 706	Polyester	0.22 µF/100 V		CS 0389
L 700	Oscillator Coil			LB 0824
L 701	Filter Choke	30 µH		LJ 0008
M 700	Erase Head	2 mH		MR 0012
Q 700	Silicon	150 V/300 mA	BAX 16	QV 0217
Q 701	Zener	6,0-7,5 V/5 mA	ZG 6,8	QV 1106
R 700,701	Carbon	1/4 W 5%	4,7 kΩ	RB 3470
R 702,703	-	- -	470 Ω	RB 2470
R 704,705	Wire	1 W -	1 Ω	RR 0001
R 706	Carbon	1/4 W -	10 kΩ	RB 4100
V 700,701	Silicon	NPN	2 N 3704	VB 0028
V 702	-	NPN	2 N 4922	VB 0063
V 703	-	NPN	BC 109	VB 0047
	Printed Circuit Board			XC 0989
	Selftapping Screw			YS 0222

BC109

2N3704

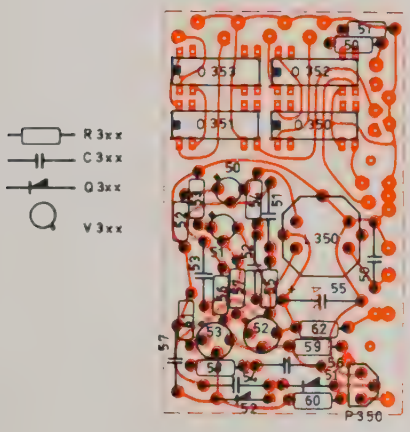
2N4922

Bottom view



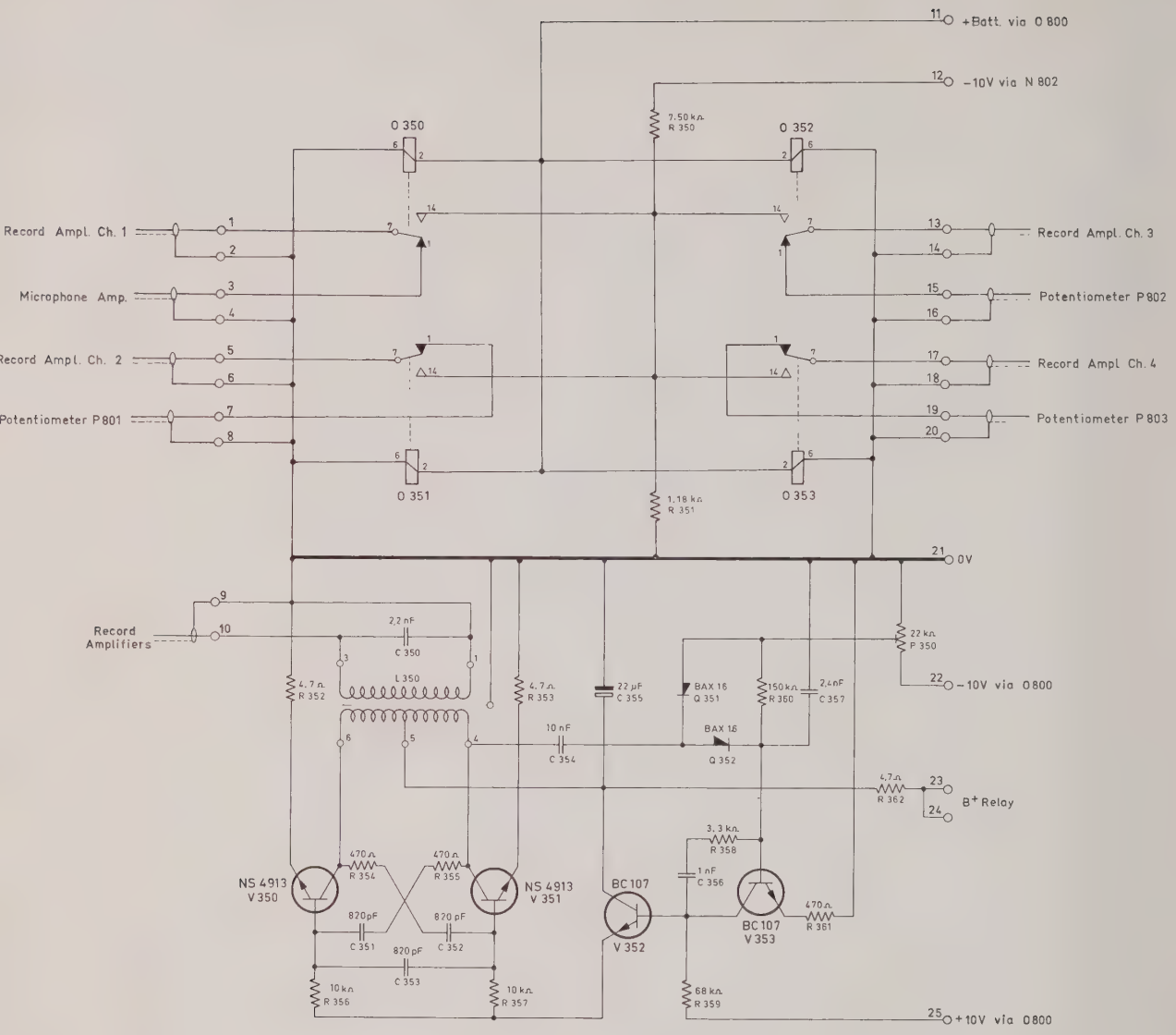
Viewed from the component side

Circuit and Layout Diagrams with Parts List

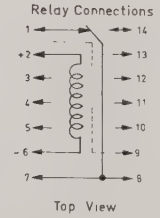


viewed from the component side

C 350	Polystyrene			2,2 nF/250 V	CT 1180
C 351 – 353	-			820 pF/ 63 V	CT 1121
C 354	-			10 nF/ 30 V	CT 1552
C 355	Electrolytic			22 µF/ 10 V	CE 0203
C 356	Polystyrene			1 nF/ 63 V	CT 1132
C 357	-			2,4 nF/ 63 V	CT 1129
L 350	Oscillator coil				LB 0889
O 350-353	Relay				OC 0062
P 350	Trimmer Cermet	lin.		22 kΩ	PG 3220
Q 351, 352	Silicon	150 V/300 mA		BAX 16	QV 0217
R 350	Metal	1/4 W	1%	7.50 kΩ	RF 3750
R 351	-	-	-	1.18 kΩ	RF 3118
R 352,353	Carbon	1/8 W	10%	4,7 Ω	RA 0203
R 354,355	-	1/4 W	5%	470 Ω	RB 2470
R 356,357	-	-	-	10 kΩ	RB 4100
R 358	-	-	-	3.3 kΩ	RB 3330
R 359	-	-	-	68 kΩ	RB 4680
R 360	-	-	-	150 kΩ	RB 5150
R 361	-	-	-	470 Ω	RB 2470
R 362	-	-	-	4,7 Ω	RA 0203
V 350,351	Silicon	NPN		2 N 3704	VB 0257
V 352,353	-	NPN		BC 107	VB 0032
	Printed Circuit Board				XC 0904



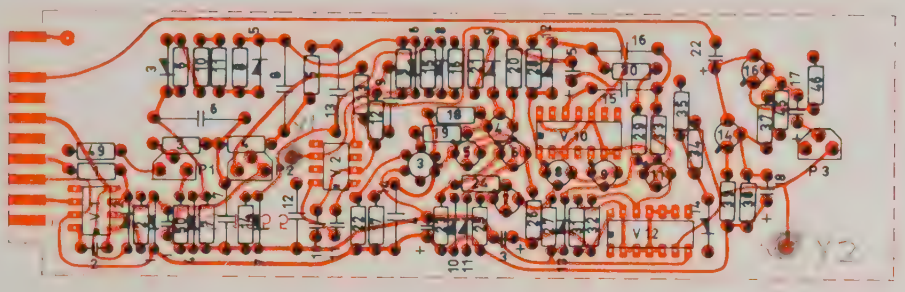
Bottom view



Top View

Circuit and Layout Diagrams with Parts List

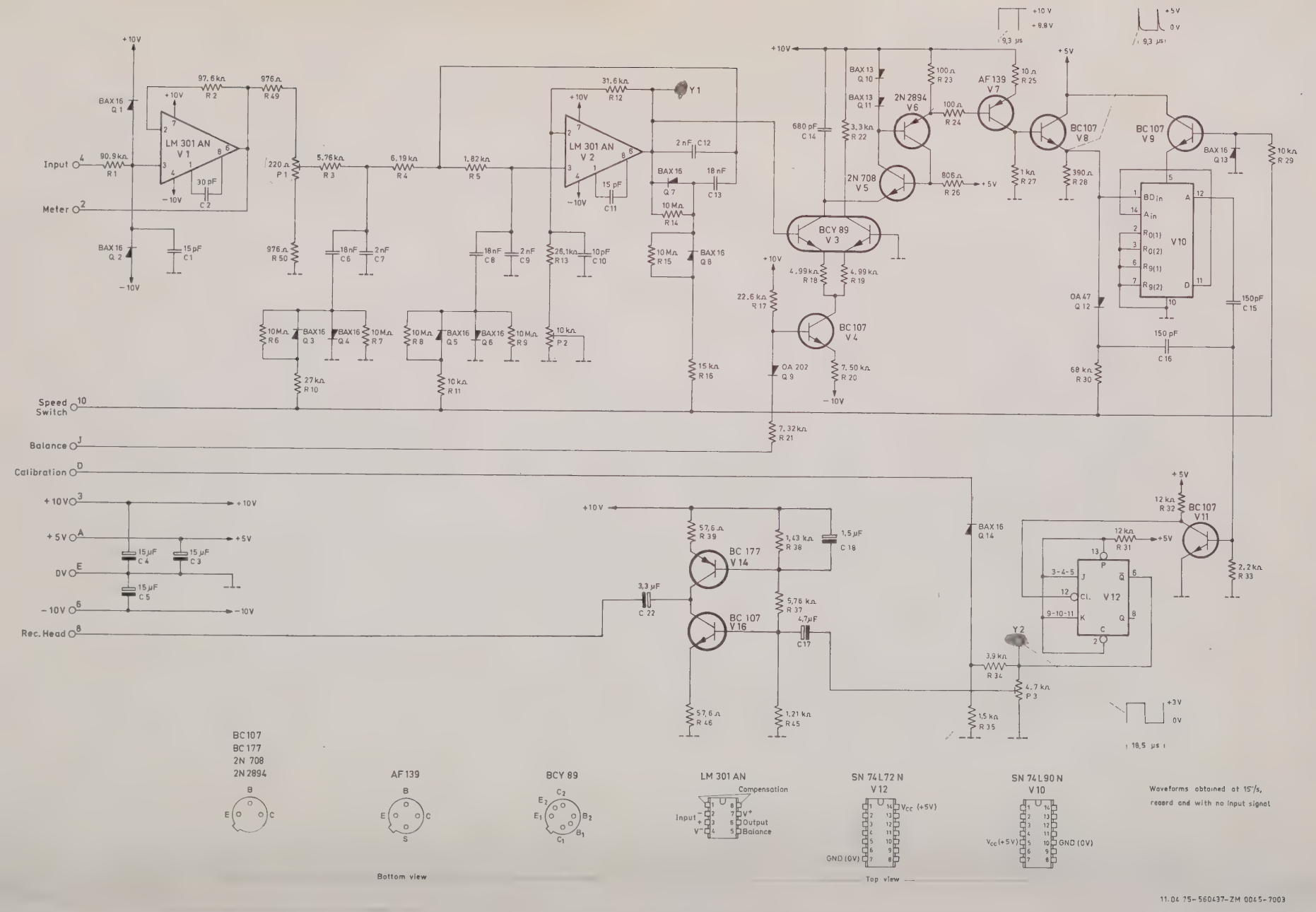
R
C
Q
V



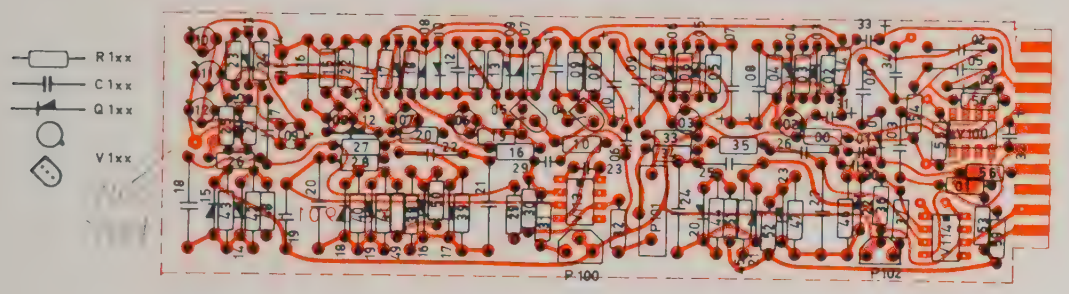
viewed from the component side

C 1	Ceramic			15 pF/400 V	CK 1150	R 17	Metal	1/4 W	1%	22.6 kΩ	RF 4226
C 2				30 pF/400 V	CK 0105	R 18-19	·	·	·	4.99 kΩ	RF 3499
C 3-5	Tantalum			15 µF/ 20 V	CF 0010	R 20	·	·	·	7.50 kΩ	RF 3750
C 6	Polystyrene			18 nF/ 63 V	CT 1516	R 21	·	·	·	7.32 kΩ	RF 3732
C 7				2 nF/ 63 V	CT 1123	R 22	Carbon	·	5%	3.3 kΩ	RB 3330
C 8				18 nF/ 63 V	CT 1516	R 23-24	·	·	·	100 Ω	RB 2100
C 9	·			2 nF/ 63 V	CT 1123	R 25	·	·	·	10 Ω	RB 1100
C 10	Ceramic			10 pF/400 V	CK 1100	R 26	Metal	·	1%	806 Ω	RF 2806
C 11				15 pF/400 V	CK 1150	R 27	Carbon	·	5%	1 kΩ	RB 3100
C 12	Polystyrene			2 nF/ 63 V	CT 1123	R 28	·	·	·	390 Ω	RB 2390
C 13				18 nF/ 63 V	CT 1516	R 29	·	·	·	10 kΩ	RB 4100
C 14				680 pF/125 V	CT 1134	R 30	·	·	·	68 kΩ	RB 4680
C 15,16	·			150 pF/125 V	CT 1139	R 31,32	·	·	·	12 kΩ	RB 4120
C 17	Tantalum			4,7 µF/ 35 V	CF 0051	R 33	·	·	·	2.2 kΩ	RB 3220
C 18				1,5 µF/ 35 V	CF 0008	R 34	·			3,9 kΩ	RB 3390
C 22	·			3,3 µF/ 16 V	CF 0014	R 35	·	·	·	1,5 kΩ	RB 3150
						R 37	Metal	·	1%	5,76 kΩ	RF 3576
P 1	Trimmer	Cermet	lin.	220 Ω	PG 1220	R 38	·	·	·	1,43 kΩ	RF 3143
P 2	·			10 kΩ	PG 3110	R 39	·	·	·	57,6 Ω	RF 1576
P 3				4.7 kΩ	PG 2471	R 45	·	·	·	1,21kΩ	RF 3121
						R 46	·	·	·	57,6 Ω	RF 1576
Q 1-8	Silicon	150 V/300 mA		BAX 16	QV 0217	R 49,50	·	·	·	976 Ω	RF 2976
Q 9		150 V/ 30 mA		OA 202	QV 0202						
Q 10,11		50 V/150 mA		BAX 13	QV 0223	V 1,2	Op. Ampl.			LM 301 AN	VE 0044
Q 12	Germanium	25 V/110 mA		OA 47	QV 0094	V 3	Silicon	dual NPN		BCY 89	VB 5304
Q 13,14	Silicon	150 V/300 mA		BAX 16	QV 0217	V 4	·	NPN		BC 107	VB 0032
						V 5	·	NPN		2 N 708	VB 0535
R 1	Metal	1/4 W	1%	90.9 kΩ	RF 4909	V 6	·	PNP		2 N 2894	VB 0093
R 2	·	·	·	97.6 kΩ	RF 4976	V 7	Germanium	PNP		AF 139	VB 0033
R 3	·	·	·	5.76 kΩ	RF 3576	V 8,9	Silicon	NPN		BC 107	VB 0032
R 4		·	·	6.19 kΩ	RF 3619	V 10	Decade Counter			SN 74 L 90	VD 0050
R 5		·	·	1.82 kΩ	RF 3182	V 11	Silicon	NPN		BC 107	VB 0032
R 6-9	Carbon	1/8 W	10%	10MΩ	RA 0025	V 12	M-S-J-K Flip-Flop			SN 74 L 72 N	VD 0049
R 10		1/4 W	5%	27 kΩ	RB 4270	V 14	Silicon	PNP		BC 177	VB 0071
R 11			·	10 kΩ	RB 4100	V 16	·	NPN		BC 107	VB 0032
R 12	Metal		1%	31.6 kΩ	RF 4316						
R 13			·	26.1 kΩ	RF 4261						
R 14-15	Carbon	1/8 W	10%	10MΩ	RA 0025						
R 16		1/4 W	5%	15 kΩ	RB 4150						

Printed Circuit Board XC 1355


+10V
97,6 kΩ R 2
976 Ω R 49
BAX 16 Q 1
LM 301 AN V 1
Input 4
90,9 kΩ R 1
Meter 2
30 pF C 2
BAX 16 Q 2
15 pF C 1
−10V
220 Ω P 1
5,76 kΩ R 3
6,19 kΩ R 4
1,82 kΩ R 5
976 Ω R 50
18 nF C 6
2 nF C 7
18 nF C 8
2 nF C 9
26,1 kΩ R 13
10 pF C 10
10 MΩ R 6
BAX16 Q 3
BAX16 Q 4
10 MΩ R 7
10 MΩ R 8
BAX16 Q 5
BAX16 Q 6
10 MΩ R 9
10 kΩ P 2
27 kΩ R 10
10 kΩ R 11
31,6 kΩ R 12
Y 1
LM 301 AN V 2
15 pF C 11
2 nF C 12
BAX 16 Q 7
18 nF C 13
10 MΩ R 14
10 MΩ R 15
BAX 16 Q 8
15 kΩ R 16
Speed Switch 10
Balance J
Calibration D
+10V 3
+5V A
0V E
−10V 6
Rec. Head 8
15 µF C 4
15 µF C 3
15 µF C 5
680 pF C 14
3,3 kΩ R 22
BAX 13 Q 10
BAX 13 Q 11
2N 2894 V 6
2N 708 V 5
100 Ω R 23
100 Ω R 24
806 Ω R 26
AF 139 V 7
10 Ω R 25
1 kΩ R 27
BC 107 V 8
390 Ω R 28
BC 107 V 9
10 kΩ R 29
BAX 16 Q 13
BCY 89 V 3
4,99 kΩ R 18
4,99 kΩ R 19
22,6 kΩ R 17
BC 107 V 4
OA 202 Q 9
7,50 kΩ R 20
7,32 kΩ R 21
OA 47 Q 12
150 pF C 15
150 pF C 16
68 kΩ R 30
BD in
A in
R0(1)
R0(2)
R9(1)
R9(2)
V 10
A
D
+10 V
+ 8,8 V
9,3 µs
+5 V
0 V
9,3 µs
3,3 µF C 22
57,6 Ω R 39
BC 177 V 14
1,43 kΩ R 38
1,5 µF C 18
5,76 kΩ R 37
4,7 µF C 17
BC 107 V 16
57,6 Ω R 46
1,21 kΩ R 45
BAX 16 Q 14
12 kΩ R 32
BC 107 V 11
12 kΩ R 31
2,2 kΩ R 33
P
Q
J
Cl.
K
C
V 12
3-4-5
9-10-11
Y 2
3,9 kΩ R 34
4,7 kΩ P 3
1,5 kΩ R 35
+3V
0V
18,5 µs
BC107
BC177
2N 708
2N2894
AF139
BCY 89
LM 301 AN
Compensation
Input
Output
Balance
SN 74L72 N
V 12
SN 74L90 N
V 10
GND (0V)
Bottom view
Top view
Waveforms obtained at 15'/s, record and with no input signal
11.04 75-560437-ZM 0045-7003

Circuit and Layout Diagrams with Parts List



viewed from the component side

C 100	Polystyrene	10 nF/ 30 V	CT 1552	
C 101	Tantalum	100 µF/ 3 V	CF 0019	
C 102	Polystyrene	1 nF/ 63 V	CT 1132	
C 103	-	3 nF/ 30 V	CT 1157	
C 105	Polyester	47 nF/250V	CS 0550	
C 106	Tantalum	15 µF/ 20 V	CF 0010	
C 107-110	Electrolytic	12.5 µF/ 25 V	CE 0416	
C 111,112	Polystyrene	82 pF/ 63 V	CT 0504	
C 113	-	160 pF/125 V	CT 1130	
C 114	Trimmer	3.5-10 pF	CV 0042	
C 115	Ceramic	4.7 pF/400 V	CK 0470	
C 116	Polystyrene	1500 pF/ 63 V	CT 1151	
C 117	-	910 pF/ 63 V	CT 1147	
C 118	-	8.2 nF/ 63 V	CT 1556	
C 119	-	910 pF/ 63 V	CT 1147	
C 120,121	-	8.2 nF/ 63 V	CT 1556	
C 122	-	910 pF/ 63 V	CT 1147	
C 123	Ceramic	15 pF/400 V	CK 1150	
C 124	Polystyrene	8.2 nF/ 63 V	CT 1556	
C 125,126	-	910 pF/ 63 V	CT 1147	
C 127	-	8.2 nF/ 63 V	CT 1556	
C 128	Ceramic	15 pF/400 V	CK 1150	
C 129	-	4.7 pF/400 V	CK 0470	
C 130	-	6.8 pF/400 V	CK 0680	
C 131	Tantalum	15 µF/ 20 V	CF 0010	
C 132	-	10 µF/ 16 V	CF 0059	
C 133	-	15 µF/ 10 V	CF 0016	
C 134	-	4,7 µF/ 30 V	CF 0021	

P 100	Trimmer	Cermet	lin.	22 kΩ	PG 3220
P 101	-	Wire	-	1 kΩ	PG 2110
P 102	-	Cermet	-	10 kΩ	PG 3110

Q 100 104	Silicon	150 V/300 mA	BAX 16	QV 0217
Q 105,106	-	200 V/ 40 mA	13 P 2	QV 0022
Q 107-110	-	150 V/300 mA	BAX 16	QV 0217
Q 111	-	50 V/150 mA	BAX 13	QV 0223
Q 112	-	150 V/300 mA	BAX 16	QV 0217
Q 113	-	150 V/ 30 mA	OA 202	QV 0202
Q 114-123	-	150 V/300 mA	BAX 16	QV 0217

R 100	Metal	1/4 W	1%	15 Ω	RF 1150
R 101	Carbon	-	5%	47 Ω	RB 1470
R 102		-	-	22 kΩ	RB 4220
R 103	-	-	-	3.3 kΩ	RB 3330
R 104	-	-	-	3.9 kΩ	RB 3390
R 105	-	-	-	22 kΩ	RB 4220
R 106	-	-	-	3.3 kΩ	RB 3330

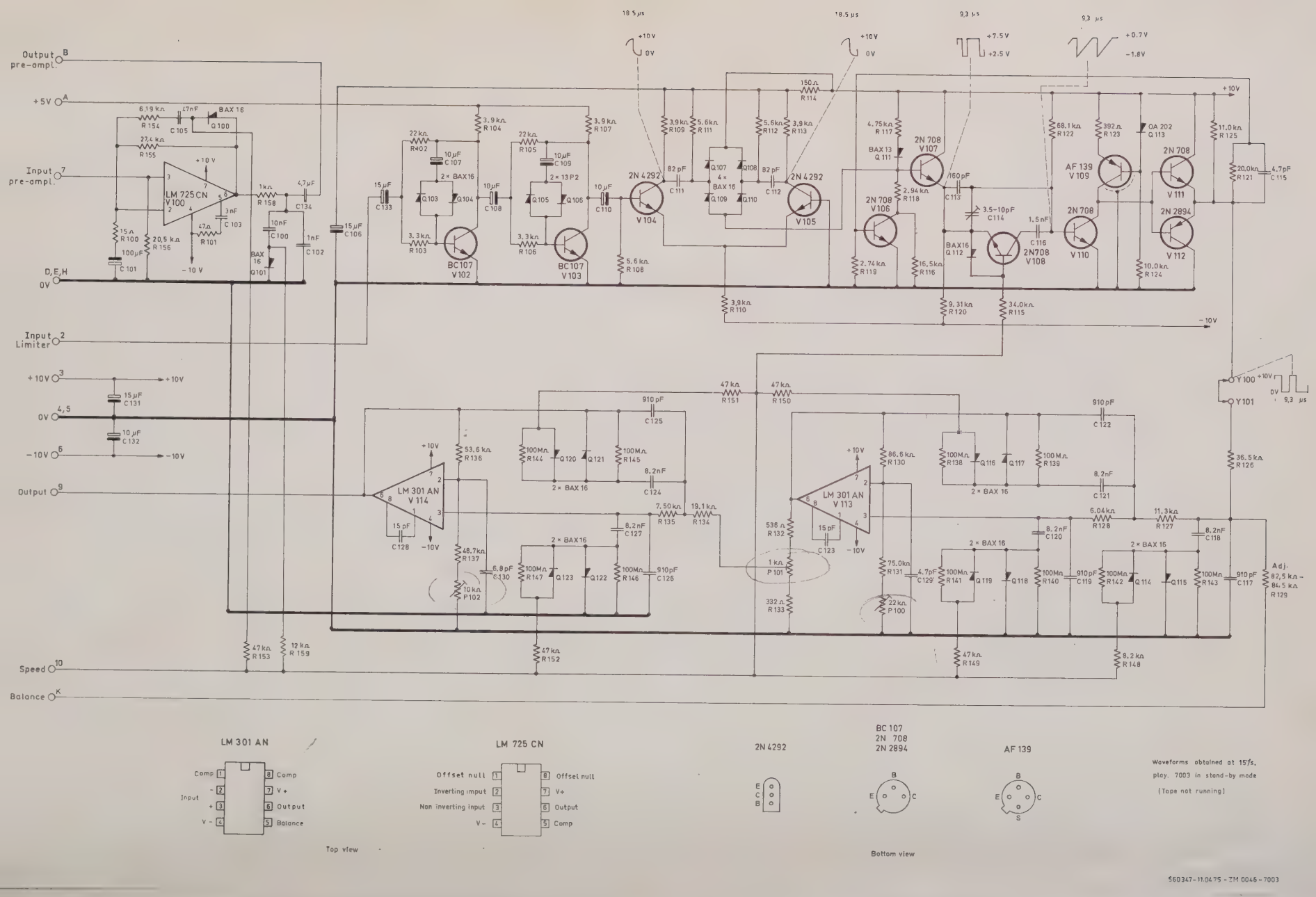
R 107	Carbon	1/4 W	5%	3.9 kΩ	RB 3390
R 108	-	-	-	5.6 kΩ	RB 3560
R 109,110	-	-	-	3.9 kΩ	RB 3390
R 111,112	-	-	-	5.6 kΩ	RB 3560
R 113	-	-	-	3.9 kΩ	RB 3390
R 114	-	-	-	150 Ω	RB 2150
R 115	Metal	-	1%	34.0 kΩ	RF 4340
R 116	-	-	-	16.5 kΩ	RF 4165
R 117	-	-	-	4.75 kΩ	RF 3475
R 118	-	-	-	2.94 kΩ	RF 3294
R 119	-	-	-	2.74 kΩ	RF 3274
R 120	-	-	-	9.31 kΩ	RF 3931
R 121	-	-	-	20.0 kΩ	RF 4200
R 122	-	-	-	68.1 kΩ	RF 4681
R 123	-	-	-	392 Ω	RF 2392
R 124	-	-	-	10.0 kΩ	RF 4100
R 125	-	-	-	11.0 kΩ	RF 4110
R 126	-	-	-	36.5 kΩ	RF 4365
R 127	-	-	-	11.3 kΩ	RF 4113
R 128	-	-	-	6.04 kΩ	RF 3604
R 129	-	-	82,5 kΩ-84,5 kΩ		
R 130	-	-	1%	86.6 kΩ	RF 4866
R 131	-	-	-	75.0 kΩ	RF 4750
R 132	-	-	-	536 Ω	RF 2536
R 133	-	-	-	332 Ω	RF 2332
R 134	-	-	-	19.1 kΩ	RF 4191
R 135	-	-	-	7.50 kΩ	RF 3750
R 136	-	-		53.6 kΩ	RF 4536
R 137	-		-	48.7 kΩ	RF 4487
R 138-147	Carbon	-	10%	100MΩ	RH 0004
R 148	-		5%	8.2 kΩ	RB 3820
R 149-153	-		-	47 kΩ	RB 4470
R 154	Metal		1%	6,19 kΩ	RF 3619
R 155	-	-		27,4 kΩ	RF 4274
R 156	-		-	20.5 kΩ	RF 4205
R 158	Carbon		5%	1 kΩ	RB 3100
R 159				12 kΩ	RB 4120

V 100	Op. Ampl.		LM 725	VE 0047
V 102,103	Silicon	NPN	BC 107	VB 0257
V 104,105	-	NPN	2 N 4292	VB 0050
V 106-108	-	NPN	2 N 708	VB 0535
V 109	Germanium	PNP	AF 139	VB 0033
V 110,111	Silicon	NPN	2 N 708	VB 0535
V 112		PNP	2 N 2894	VB 0093
V 113,114	Op. Ampl.		LM 301 AN	VE 0044

Printed Circuit Board	XC 0901

ZM 0046

7003 from serial no 560347

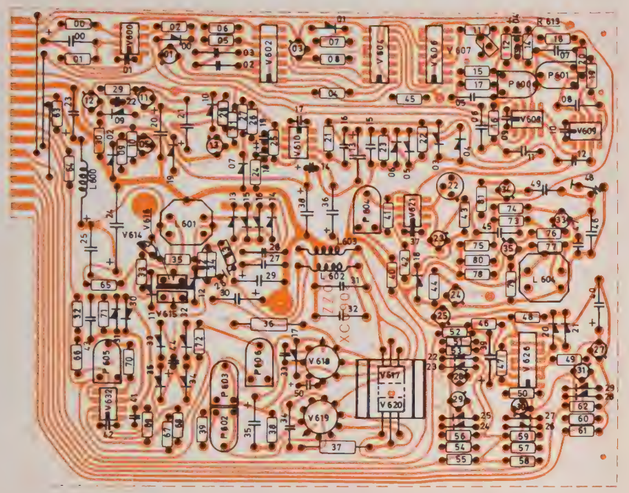

Output pre-ampl. B
+5V A
Input pre-ampl. 7
D,E,H
0V
Input Limiter 2
+10V 3
0V 4,5
−10V 6
Output 9
Speed 10
Balance K
LM 725CN V100
LM 301 AN V 114
LM 301 AN V 113
BC107 V102
BC107 V103
2N 4292 V 104
2N 4292 V105
2N 708 V106
2N 708 V107
2N708 V108
AF 139 V 109
2N 708 V 110
2N 708 V111
2N 2894 V 112
BAX 16 Q101
BAX 16 Q112
BAX 13 Q 111
OA 202 Q 113
Y 100
Y 101
18,5 µs
18,5 µs
9,3 µs
9,3 µs
+10V
0V
+7,5 V
+2,5 V
+0,7 V
−1,8V
9,3 µs
LM 301 AN
LM 725 CN
2N 4292
BC 107
2N 708
2N 2894
AF 139
Top view
Bottom view
Waveforms obtained at 15 f/s, play. 7003 in stand-by mode (Tape not running)
560347-11.0475 - ZM 0046-7003

BRÜEL & KJÆR
Nærum – Denmark

Circuit and Layout Diagrams with Parts List

ZZ 0026

Main Board

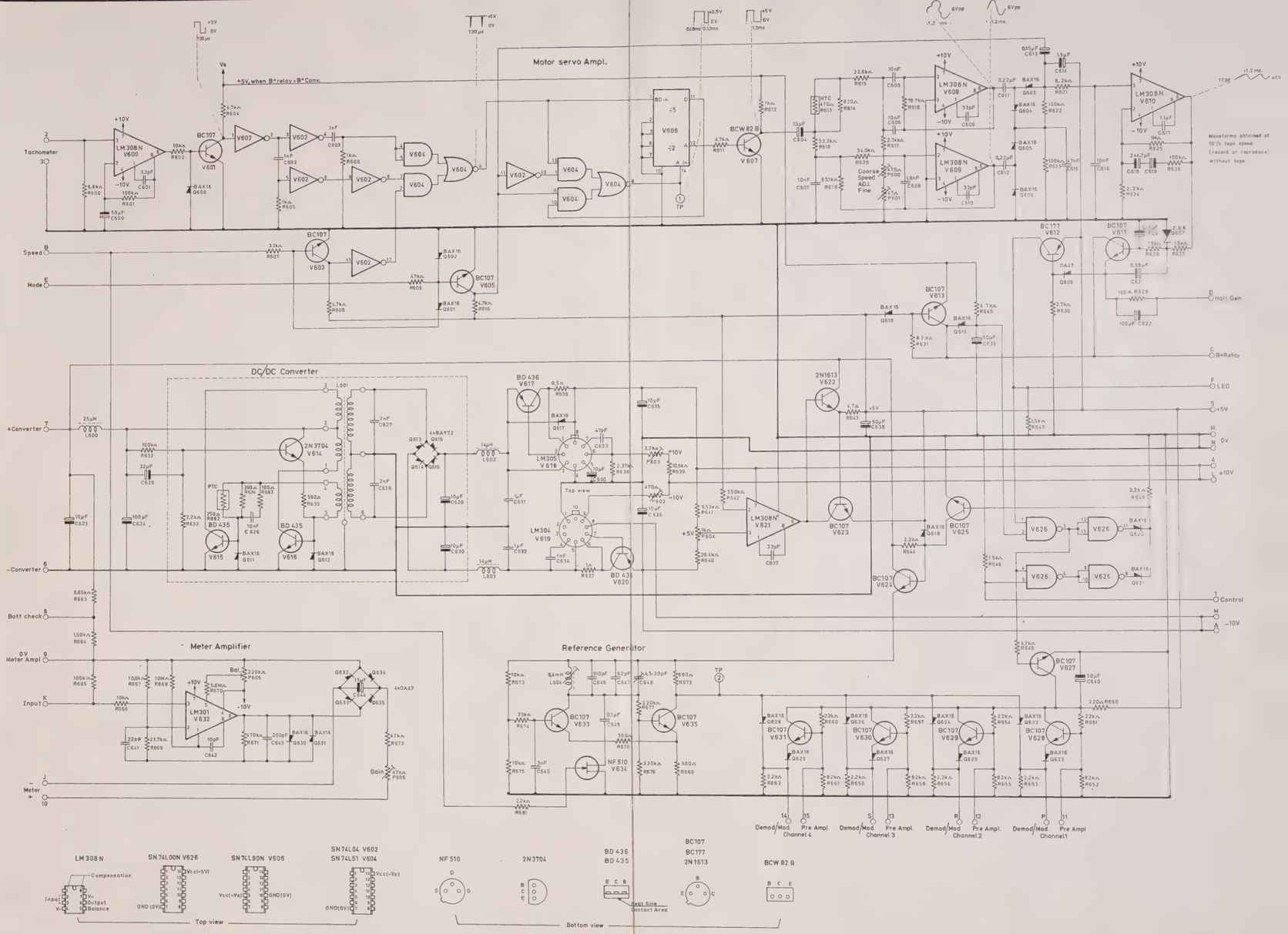


viewed from the printed circuit side

R 6xx
C 6xx
Q 6xx
V 6xx

C 600	Electrolytic	50 µF/ 6.4 V	CE 0204	C 642	Ceramic	10 pF/400 V		CK 1100
C 601	Ceramic	3.3 pF/250 V	CK 0331	C 643	Polystyrene	200 pF/100 V		CT 1118
C 602,603	Polystyrene	1 nF/ 63 V	CT 1132	C 644	Tantalum	15 µF/ 20 V		CF 0010
C 604	Tantalum	1.5 µF/ 35 V	CF 0008	C 645	Polystyrene	3 nF/ 30 V		CT 1157
C 605-607	Polystyrene	10 nF/ 30 V	CT 1552	C 646	-	910 pF/ 63 V		CT 1147
C 608	-	1.8 nF/ 64 V	CT 1127	C 647	Ceramic	82 pF/ 63 V		CK 1820
C 609,610	Ceramic	33 pF/400 V	CK 1330	C 648	-	4.5-20 pF		CV 0020
C 611,612	Polycarbonate	220 nF/100 V	CS 0389	C 649	Polycarbonate	0.1 µF/100 V		CS 0409
C 613	Tantalum	0.15 µF/ 35 V	CF 0033	C 650	Tantalum	10 µF/ 3 V		CF 0032
C 614	-	1.5 µF/ 35 V	CF 0008					
C 615	Polyester	47 nF/250 V	CS 0401	L 600	Filter Choke	25 µH		LJ 0018
C 616	-	10 nF/250 V	CS 0394	L 601	Converter Coil			LB 0822
C 617	Ceramic	33 pF/400 V	CK 1330	L 602,603	Filter Choke	14 µH		LJ 0009
C 618,619	Tantalum	4.7 µF/ 10 V	CF 0018	L 604	Ref. Gen. Coil			LB 0821
C 620	-	0.15 µF/ 35 V	CF 0033					
C 621	-	0.68 µF/ 35 V	CF 0044	P 600	Trimmer	Cermet	lin.	470 Ω	PG 1504
C 622	-	100 µF/ 3 V	CF 0019	P 601	-	-	-	47 Ω	PG 0470
C 623	Electrolytic	10 µF/ 25 V	CE 0416	P 602	-	-	-	470 Ω	PG 1504
C 624	-	100 µF/ 16 V	CE 0310	P 603	-	-	-	2.2 kΩ	PG 2207
C 625	-	22 µF/ 10 V	CE 0203	P 604	-	-	-	1 kΩ	PG 2108
C 626	Polycarbonate	10 nF/400 V	CS 0101	P 605	-	-	-	220 kΩ	PG 4204
C 627,628	Polystyrene	2 nF/ 63 V	CT 1123	P 606	-	-	-	47 kΩ	PG 3471
C 629,630	Electrolytic	10 µF/ 40 V	CE 0414						
C 631,632	Polycarbonate	1 µF/100 V	CS 0384	Q 600-606	Silicon	150 V/300 mA		BAX 16	QV 0217
C 633	Ceramic	47 pF/400 V	CK 1470	Q 607	Zener	6–7.5V/0.4W		ZG 6,8	QV 1106
C 634	Polystyrene	1 nF/ 63 V	CT 1132	Q 609	Germanium	25 V/110 mA		OA 47	QV 0094
C 635,636	Electrolytic	10 µF/ 25 V	CE 0416	Q 610-612	Silicon	150 V/300 mA		BAX 16	QV 0217
C 637	Ceramic	33 pF/400 V	CK 1330	Q 613-616	-	100 V/225 mA		BAY 72	QV 0219
C 638-640	Electrolytic	50 µF/ 6.4 V	CE 0204	Q 617-631	-	150 V/300 mA		BAX 16	QV 0217
C 641	Ceramic	22 pF/400 V	CK 1220	Q 632-635	Germanium	25 V/110 mA		OA 47	QV 0094
				R 600	Carbon	1/4 W	5%	6,8 kΩ	RB 3680
				R 601	-	-	-	100 kΩ	RB 5100
				R 602	-	-	-	10 kΩ	RB 4100

ZZ 0026
7003/4 from serial no. 523399



560347-3 6 75 -ZZ0026-7003
523399 -7004

R 604	Carbon	1/4 W	5%	4.7 kΩ	RB 3470
R 605,606	·	·	·	1 kΩ	RB 3100
R 607	·	·	·	33 kΩ	RB 4330
R 608	·	·	·	4.7 kΩ	RB 3470
R 609	·	·	·	47 kΩ	RB 4470
R 610,611	·	·	·	4.7 kΩ	RB 3470
R 612	·	·	·	1 kΩ	RB 3100
R 613	NTC			470 Ω	RN 0015
R 614	Carbon	1/4 W	5%	820 Ω	RB 2820
R 615	Metal	·	1%	22.6 kΩ	RF 4226
R 616	·	·	·	78.7 kΩ	RF 4787
R 617	·	·	·	2.74 kΩ	RF 3274
R 618	·	·	·	52.3 kΩ	RF 4523
R 619	·	·	·	93.1 kΩ	RF 4931
R 620	·	·	·	34.0 kΩ	RF 4340
R 621	Carbon	·	5%	8.2 kΩ	RB 3820
R 622,623	·	·	·	100 kΩ	RB 5100
R 624	·	·	·	2.2 kΩ	RB 3220
R 625	·	·	·	1MΩ	RB 6100
R 626	·	·	·	100 kΩ	RB 5100
R 627,628	·	·	·	1.5 kΩ	RB 3150
R 629	·	·	·	100 Ω	RB 2100
R 630	·	·	·	2.7 kΩ	RB 3270
R 631	·	·	·	8.2 kΩ	RB 3820
R 632	·	·	·	100 kΩ	RB 5100
R 633	·	·	·	2.2 kΩ	RB 3220
R 634	·	·	·	390 Ω	RB 2390
R 635	·	·	·	560 Ω	RB 2560
R 636	Wire	2 W		0,5 Ω	RO 1203
R 637	-	1 W	·	1 Ω	RR 0001
R 638	Metal	1/4 W	1%	2.37 kΩ	RF 3237
R 639	·	·	·	10,5 kΩ	RF 4105
R 640	·	·	·	29.4 kΩ	RF 4294
R 641	·	·	·	9.53 kΩ	RF 3953
R 642	·	·	·	7.50 kΩ	RF 3750
R 643	·	·	·	4.7 Ω	RA 0203
R 644	Carbon	·	5%	2.2 kΩ	RB 3220
R 645	·	·	·	47 kΩ	RB 4470
R 646,647	·	·	·	1.5 kΩ	RB 3150
R 648	·	·	·	2.2 kΩ	RB 3220
R 649	·	·	·	4.7 kΩ	RB 3470
R 650	·	·	·	220 Ω	RB 2220
R 651	·	·	·	22 kΩ	RB 4220
R 652	·	·	·	82 kΩ	RB 4820
R 653	·	·	·	2.2 kΩ	RB 3220
R 654	·	·	·	22 kΩ	RB 4220
R 655	·	·	·	82 kΩ	RB 4820
R 656	·	·	·	2.2 kΩ	RB 3220
R 657	·	·	·	22 kΩ	RB 4220
R 658	·	·	·	82 kΩ	RB 4820
R 659	·	·	·	2.2 kΩ	RB 3220
R 660	·	·	·	22 kΩ	RB 4220
R 661	·	·	·	82 kΩ	RB 4820
R 662	·	·	·	2.2 kΩ	RB 3220
R 663	Metal	·	1%	6.65 kΩ	RF 3665
R 664	·	·	·	1.50 kΩ	RF 3150
R 665	Carbon	·	5%	100 kΩ	RB 5100
R 666	·	·	·	10 kΩ	RB 4100
R 667	Metal	·	1%	10.0 kΩ	RF 4100
R 668	Carbon	1/8 W	10%	10MΩ	RA 0025
R 669	Metal	1/4 W	1%	23.7 kΩ	RF 4237
R 670	Carbon	1/4 W	5%	5.6MΩ	RB 6560
R 671	·	·	·	470 kΩ	RB 5470
R 672	·	·	·	47 kΩ	RB 4470
R 673	·	·	·	10 kΩ	RB 4100
R 674	·	·	·	33 kΩ	RB 4330
R 675	·	·	·	10 kΩ	RB 4100
R 676	·	·	·	560 Ω	RB 2560
R 677,678	·	·	·	220 kΩ	RB 5220
R 679	·	·	·	680 Ω	RB 2680
R 680	·	·	·	560 Ω	RB 2560
R 681	·	·	·	2.2 kΩ	RB 3220
R 682	PTC			250 Ω	RN 0202
R 683	Carbon	·	·	100 Ω	RB 2100

V 600	Op. Ampl.		LM 308 AN	VE 0046
V 601	Silicon	NPN	BC 107	VB 0032
V 602	Hex-Inverter		SN 74 L 04 N	VD 0047
V 603	Silicon	NPN	BC 107	VB 0032
V 604	Dual And-Or-Invert		SN 74 L 51 N	VD 0048
V 605	Silicon	NPN	BC 107	VB 0032
V 606	Decade counter		SN 74 L 90 N	VD 0050
V 607	Silicon	NPN	BC 107	VB 0032
V 608-610	Op. Ampl.		LM 308 N	VE 0046
V 611	Silicon	NPN	BC 107	VB 0032
V 612	·	PNP	BC 177	VB 0071
V 613	·	NPN	BC 107	VB 0032
V 614	·	NPN	2 N 3704	VB 0028
V 615,616	·	NPN	BD 435	VB 0557
V 617	·	PNP	BD 436	VB 0120
V 618	Positive Volt. reg.		LM 305 H	VE 0015
V 619	Negative Volt. reg.		LM 304 H	VE 0016
V 620	Silicon	PNP	BD 436	VB 0120
V 621	Op. Ampl.		LM 308 N I	VE 0046
V 622	Silicon	NPN	2 N 1613	VB 0026
V 623-625	·	NPN	BC 107	VB 0032
V 626	4 x 2-Input NAND-Gate		SN 74 L 00 N	VD 0046
V 627-631	Silicon	NPN	BC 107	VB 0032
V 632	Op. Ampl.		LM 301 AN	VE 0017
V 633	Silicon	NPN	BC 107	VB 0032
V 634	FET	N	NF 510	VB 1021
V 635	Silicon	NPN	BC 107	VB 0032

	Printed Circuit Board	XC 0902

C 800-803	Polycarbonate	0,47 µF/100 V		CS 0412
C 804	Tantalum	15 µF/ 20 V		CF 0010
I 800	Instrument			IM 0047
J 800-803	BNC Input Socket			JJ 0121
J 804	Remote Control Socket			JJ 0605
J 805	Tuchel, 10-pole female			JJ 1000
J 806	Tuchel, 10-pole male			JP 1000
J 807	6-pole female for ZI 0021			JJ 0606
J 808	Tuchel, 10-pole male			JP 1000
J 809	Tuchel, 10-pole female			JJ 1000
J 810-813	2 x 10-pole female for p.c.b.			JJ 2006
J 814	Tuchel, 10-pole male			JP 1000
J 815	2 x 15-pole female for ZZ 0026			JJ 1502
J 816	Microphone Input Socket			JJ 0313
J 817	10-pole female for ZE 0079			JJ 1010
J 818	9-pole connector for ZH 0071			JJ 0903
J 819,820	Single Spade connector			JJ 0131
J 821,822	Tuchel, 10-pole male			JP 1000
J 823	Tuchel, 10-pole female			JJ 1000
J 824-827	2 x 10 pole female for p.c.b.			JJ 2006
J 828	Ext. Power Socket			JJ 0402
J 829-832	BNC Output Socket			JJ 0121
J 833	Fuseholder			JS 0015
	Plastic Cover for BNC Socket			DT0075
N 800-803	Off-AC-DC selector			NN 0033
N 804,805	Microswitch			NT 0034
N 806	Microswitch			NT 0201
N 807	Microswitch			NT 0204
N 808,809	Microswitch			NT 0011
N 810	Gain Check switch			NT 0029
N 811	Cal. Switch			NN 0033
N 812	Mode Switch			NN 0039
N 813	Tape Speed ips			NN 0037
N 814	Monitor Switch			NN 0039
N 815	Power Casette Switch			NT 0032
O 800	Record – 0 – Play			OI 0025
O 801	Meter and Monitor			OI 0011
O 802	Relay RS – 6 V			OC 0058
P 800-803	Input Sens.		100 kΩ	PP 4109
P 804-807	Calib. Record		1 kΩ	PG 2110
P 808-811	Calib. Play		5 kΩ	PG 2512
Q 800	Silicon	150 V/0.3 A	BAX 16	QV 0217
Q 801	-	400 V/ 1 A	1 N 4004	QV 0237
Q 802	-	150 V/0.3 A	BAX 16	QV 0217
Q 803	-	400 V/ 1 A	1 N 4004	QV 0237
Q 804	-	150 V/0.3 A	BAX 16	QV 0217
Q 805	Zener	3.9 V/ 10 W	10 Z 3.9 TS	QV 1347
Q 806-808	Light Emitting Diode		TIL 209	QV 4000

R 800-803	Carbon	1/8 W	5%	10 Ω	RA 0017
R 804	-	-	-	180 Ω	RB 2180
R 805	Wire	5 W	10%	10 Ω	RX 0324
R 806	Carbon	1/4 W	5%	270 Ω	RB 2270
R 807	-	-	-	100 kΩ	RB 5100

U 800	Gear Motor for Pinch Rollers			UM 0058
U 801	Stop Solenoid			UM 0060
U 802	Tachometer			UD 0024
V 802	Fuse		2.5 A	VF 0029
V 804	Silicon	NPN	2 N 1613	VB 0026

Knob for "Meter and Monitor" switch	SN 0030
+ Indicator	SV 0046
+ Cover	DD 0089
Knob, metal	SN 0040
+ screw	YQ 3001
Pushbutton, metal	SN 0038
Screwdriver for calibration purpose	DB 1457
Meter Counter	OB 0011
Rubber Belt for above counter	DX 0037
Microphone	MM 0009
Polycarbonate Cover	UD 0032
Cover for Tape Heads	UA 0403
Bottom Plate	UA 0402
Rear Plate	FB 0316
Front Plate (angular)	FA 0415
Cover Plate for 7003	FA 0416
Cover Plate for 7004	FA 0418
Battery Casette	ZG 0073
Battery	QB 0008
Loop Adaptor	UD 0035
Empty Reel	LS 0041
Reel with tape for 7003	QR 1003
Reel with tape for 7004	QR 1004
Leather Case	KE 0088
Shoulder Strap	DH 0215

Additional Mechanical Parts will be found in the Mechanical Section 7003/4.2.

Sub-assemblies common to 7003 and 7004 with further details on the respective sheets:

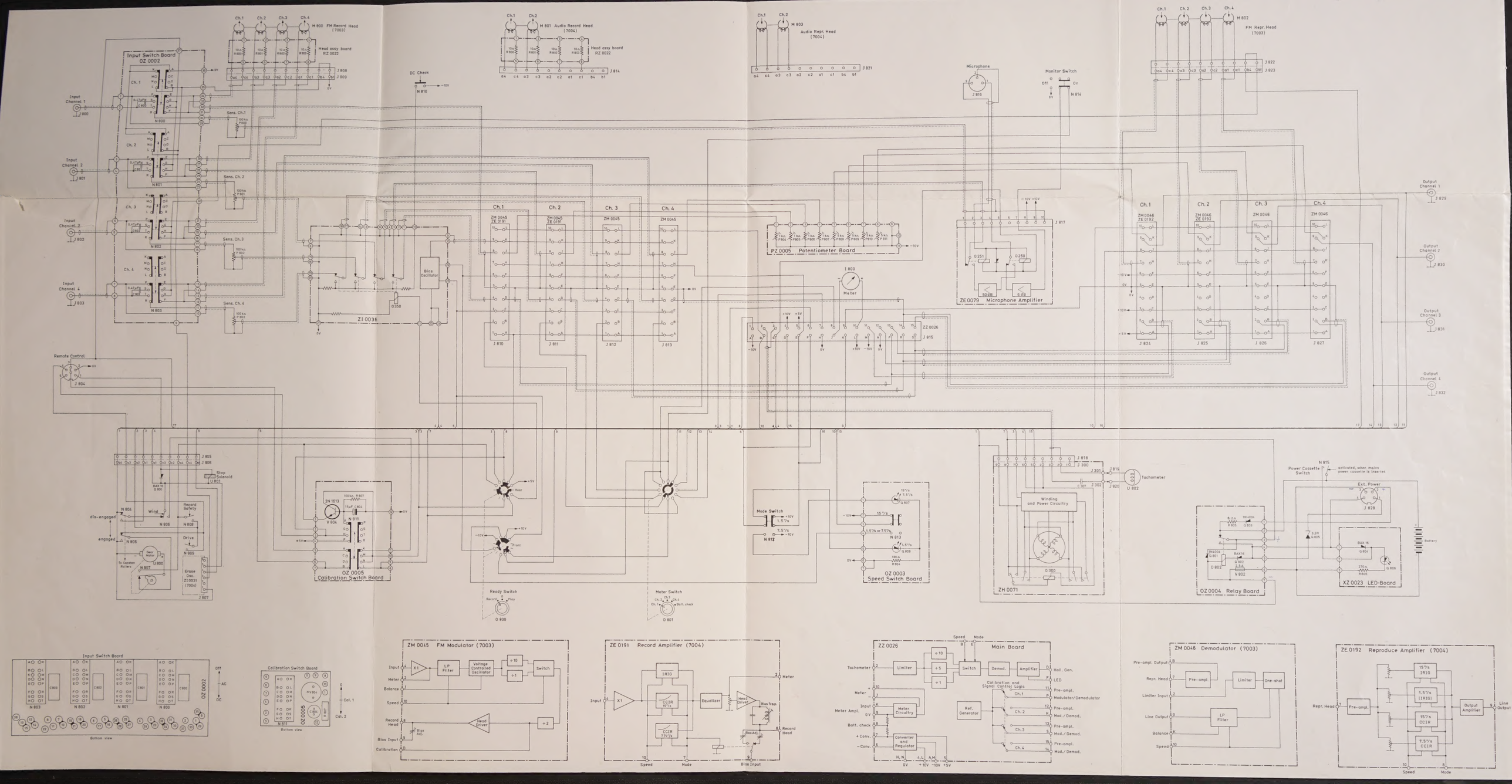
Microphone Amplifier	ZE 0079
DC Motor Board	ZH 0071
Bias Oscillator	ZI 0036
Main Board	ZZ 0026

Sub-assemblies for 7003 only:

M 800	FM Record Head	MR0019/25
M 802	FM Reproduce Head	MR0020/26
	Head Assembly M 800 + 802 + base	MR 0021
	Modulator	ZM 0045
	Demodulator	ZM 0046
	Direct Record plug-in card	ZE 0189
	Direct Reproduce plug-in card	ZE 0190

Sub-assemblies for 7004 only:

M 801	Audio Record Head	MR 0022
M 803	Audio Reproduce Head	MR 0023
	Head Assembly M 801 + 803 + base	MR 0024
	Erase Head separate with screen	MR 0012
	Record Amplifier	ZE 0191
	Reproduce Amplifier	ZE 0192
	Erase Oscillator with Erase Head	ZI 0021


Input Switch Board OZ 0002
Ch. 1
Ch. 2
Ch. 3
Ch. 4
Input Channel 1
Input Channel 2
Input Channel 3
Input Channel 4
Sens. Ch. 1
Sens. Ch. 2
Sens. Ch. 3
Sens. Ch. 4
M 800 FM Record Head (7003)
Head assy board RZ 0022
M 801 Audio Record Head (7004)
M 803 Audio Repr. Head (7004)
M 802 FM Repr. Head (7003)
DC Check
Microphone
Monitor Switch
Bias Oscillator
ZI 0036
PZ 0005 Potentiometer Board
ZE 0079 Microphone Amplifier
Meter
ZZ 0026
Output Channel 1
Output Channel 2
Output Channel 3
Output Channel 4
Remote Control
Stop Solenoid
Wind
Record Safety
Drive
Gear Motor
Erase Osc. ZI 0021 (7004)
OZ 0005 Calibration Switch Board
Ready Switch
Meter Switch
Mode Switch
OZ 0003 Speed Switch Board
Winding and Power Circuitry
ZH 0071
Tachometer
Power Cassette Switch
Ext. Power
Battery
OZ 0004 Relay Board
XZ 0023 LED-Board
Input Switch Board
Bottom view
Calibration Switch Board
Bottom view
ZM 0045 FM Modulator (7003)
ZE 0191 Record Amplifier (7004)
ZZ 0026 Main Board
ZM 0046 Demodulator (7003)
ZE 0192 Reproduce Amplifier (7004)